

Including the
ALTERNATIVES!

NUCLEAR POWER FOR BEGINNERS

By Stephen Croall and Kaianders Sempler



A QUICK WORD

YES, NUCLEAR POWER IS COMPLICATED... BUT NOT **THAT** COMPLICATED. THE BASICS ARE FAIRLY SIMPLE. ANYWAY, IT'S NOT JUST A QUESTION OF TECHNIQUES OR ECONOMICS. IT'S ABOUT THE **KIND OF SOCIETY** WE WANT FOR OURSELVES AND FUTURE GENERATIONS. IN OTHER WORDS A **POLITICAL** MATTER FOR US ALL TO DECIDE, NOT THE EXPERTS ALONE...

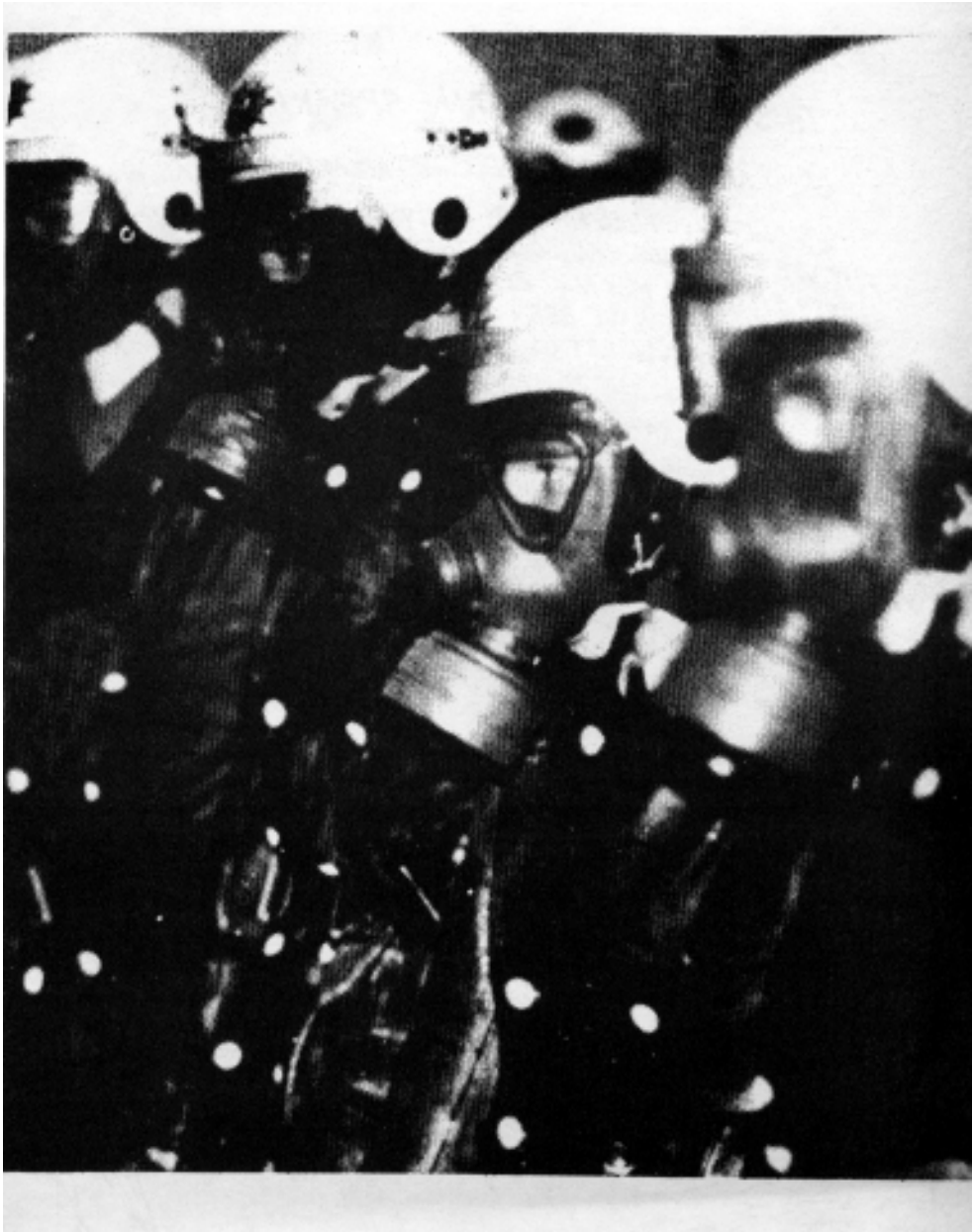
ASSEMBLING A BROAD GENERAL PICTURE OF THE NUCLEAR DILEMMA HAS INVOLVED A LOT OF PEOPLE, SOMETIMES WITHOUT THEIR KNOWLEDGE. SPECIAL THANKS TO PER JANSE, WILLIAM RANKIN, STEFAN ÅSTRÖM, KARINE MANNER, FELT & THE FISH, PER KÄGESON, MIKE FLOOD, STEN LINDBERG, UNDERCURRENTS, WRITERS WORK-SHOP IN STOCKHOLM...

...AND TO FAMILY AND FRIENDS, THANKS FOR STANDING IN WHEN WE DISAPPEARED AND PRETENDING TO LAUGH AT OUR JOKES...



SC & KS





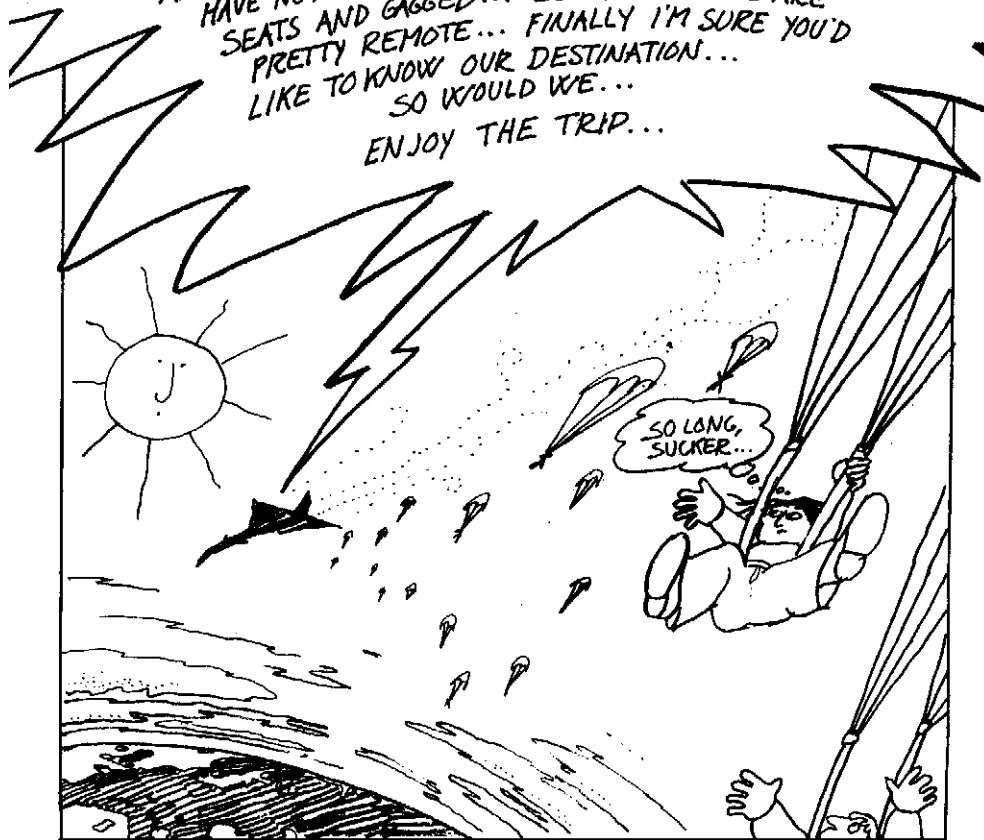
THIS IS YOUR CAPTAIN SPEAKING...

GOOD AFTERNOON AND WELCOME ABOARD ATOMIC AIRWAYS.

WE ONLY HAVE FUEL FOR THE EARLY STAGES OF THIS FLIGHT, BUT WE THINK WE CAN SOLVE THAT EN ROUTE... THE OTHER SAFETY PROBLEMS MAY ALSO BE SORTED OUT IN TIME... OUR TECHNICAL BOYS HAVE BEEN WORKING ON THEM FOR 30 YEARS, AND THEY'LL LET US KNOW IF THEY COME UP WITH ANY ANSWERS...

AS FOR SABOTAGE... WELL, IT'S ALWAYS A POSSIBILITY... AFTER ALL WE LIVE IN DANGEROUS TIMES... BUT YOU'LL HAVE NOTICED THAT YOU'RE ALL HANDCUFFED TO YOUR SEATS AND GAGGED... SO THE CHANCES ARE PRETTY REMOTE... FINALLY I'M SURE YOU'D LIKE TO KNOW OUR DESTINATION... SO WOULD WE...

ENJOY THE TRIP...

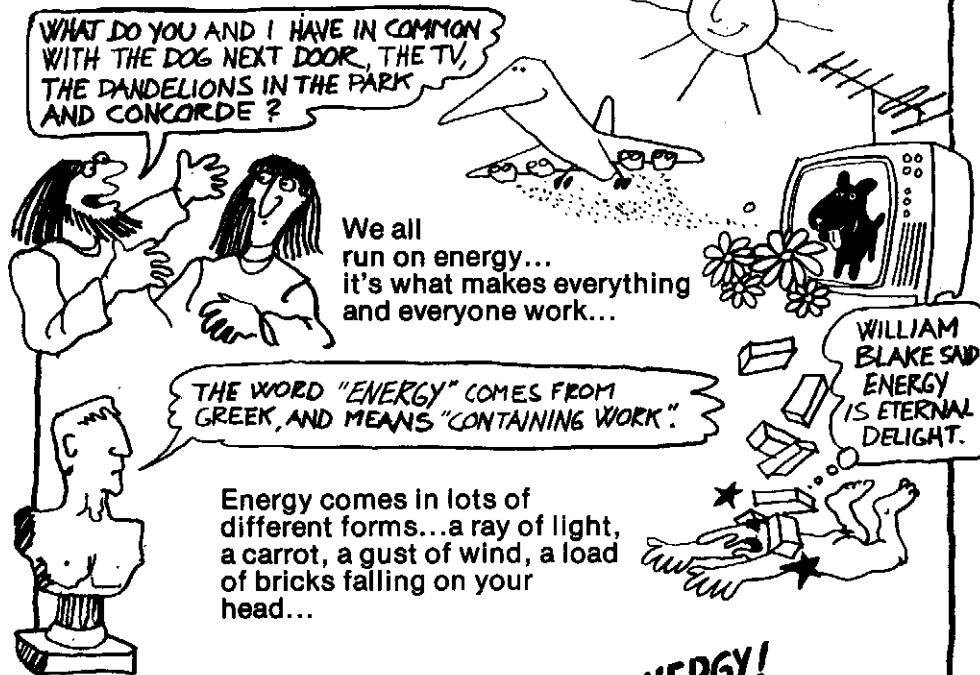


HERE COMES **CHAPTER 1.**

In which the meaning of energy remains a mystery and history is reduced to a quick flit from wood-burning to Crazy Joe's Massacree...



Before the Nuke...



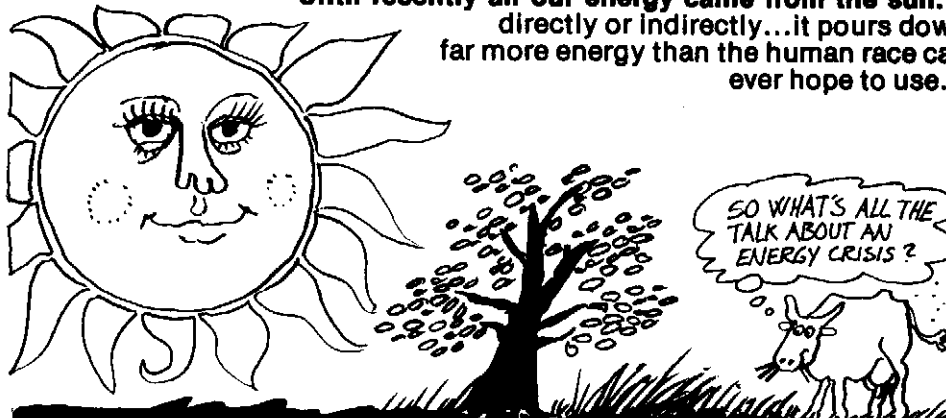
Without energy the world and everything in it would turn into a slime... that's because everything is striving to level itself out, to become 'average'... mountains left to their own devices crumble into the sea... seas fill up with crumbling mountain and they meet halfway... a cup of hot tea cools down... ice cubes thaw... a new-born baby dies... **UNLESS ENERGY HALTS THE PROCESS!**

This is called **The Law of Maximal Entropy...**

FOOD IS ENERGY!

IT HASN'T GOT MUCH TO DO WITH THIS BOOK, BUT WE THOUGHT YOU'D LIKE TO IMPRESS YOUR FRIENDS.

Until recently all our energy came from the sun...
directly or indirectly...it pours down
far more energy than the human race can
ever hope to use..



But to start from the beginning
(whenever that was)...the first
men and women only had food as a
source of energy. Tired of
jumping up and down to keep warm
they lit a fire...so wood was the
first fuel...



Everyone helped themselves generously to what looked like an
endless supply of energy...and by the Christian Era the forests
of northern Africa and the Middle East had all
but vanished — gone to
fuel, building timber
and farmland...

TODAY WE KNOW THESE
REGIONS AS DESERT.

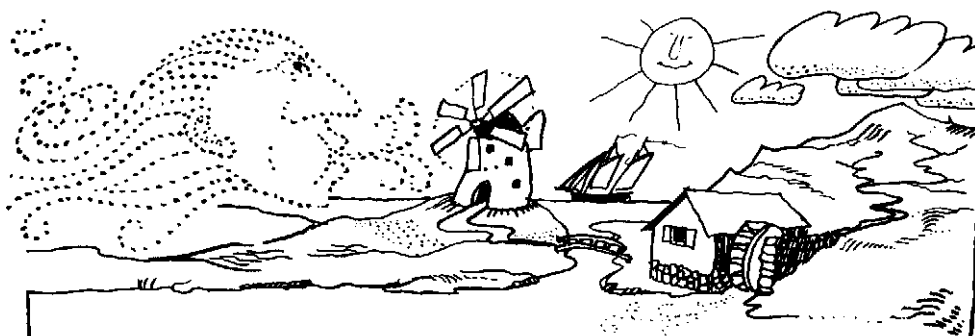
People shouldered their bags, moved on
to Western Europe and spent the Middle Ages
cutting down all the trees
there instead...



Strangely, they didn't start
clearing the North American
continent until modern times
...and there's still some virgins
forests in Siberia and the amazons...

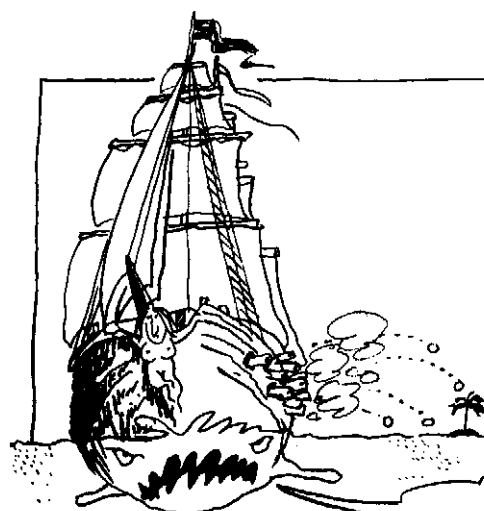


YEAH, WE'RE GETTING ROUND TO THEM...



After wood came wind and water...well, they'd been there for some time but people hadn't realised they could be used to make things move...when that idea hit home, there was a scramble to knock up windmills, wind pumps, watermills, sailing ships and so on...

Sounds fine, but...the wind also blew the ships of the 'civilised countries' far afield and enabled them to plunder, enslave and colonise 'uncivilised countries'

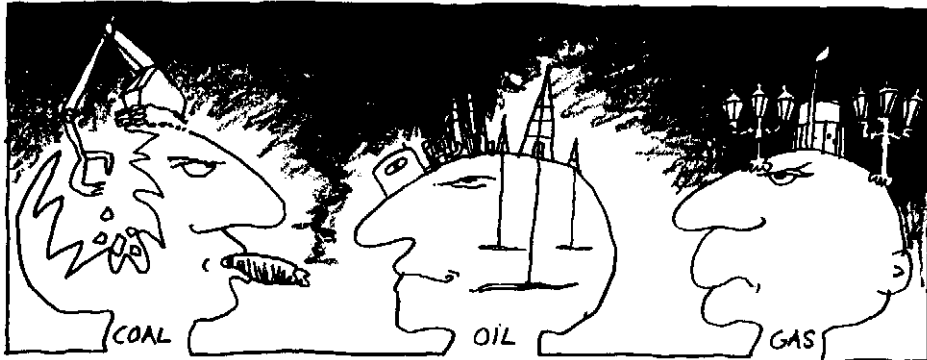


The British were so good at this particular sport that they ran out of timber for shipbuilding...luckily they had lots of coal to use as fuel...so they began mining it on a big scale...and sparked off **THE INDUSTRIAL REVOLUTION...**

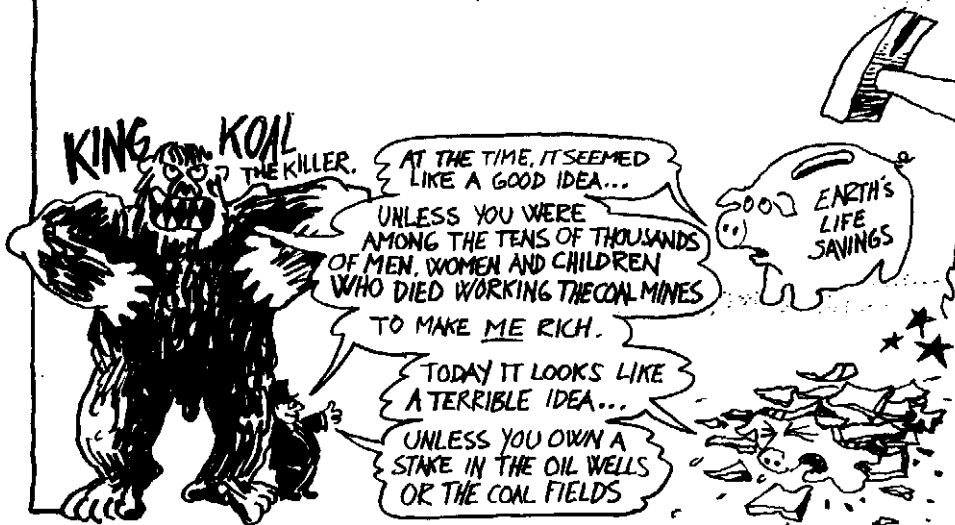
OTHERWISE KNOWN AS THE BIRTH OF CAPITALISM...

COAL and the steam-engine launched the machine age in the 18th century...by the middle of the 19th **OIL & GAS** were also being brought out of the ground...

WONDER IF THEY'LL START MAKING SAUSAGES FROM COAL TOO...



Thus the Industrial Revolution heralded a new environmental era — the speedy exploitation of an energy supply that could not be renewed...**FOSSIL FUELS**...



The sun spent 600 million years fossilising marine life into oil and trees into coal...and at the rate we're going today they'll be used up within the next few hundred years..

NO MORE OIL...
NO MORE COAL...
GOOD-BYE GAS...



NON-RENEWABLE SOURCES OF ENERGY

like coal, oil and natural gas — and uranium, the raw material for nuclear power — have certain things in common that appeal to ruling minorities...



THAT'S GRATITUDE FOR YOU!



RENEWABLE SOURCES OF ENERGY

— sun, wind, water & plants — are something else...

IT'S NOT EASY TO CORNER THE MARKET IN SUNSHINE...



They're almost impossible to exhaust...they're available in many parts of many countries...and they're potentially easier and cheaper to harness...

Far too democratic for some...

...OR CENTRALIZE WIND...

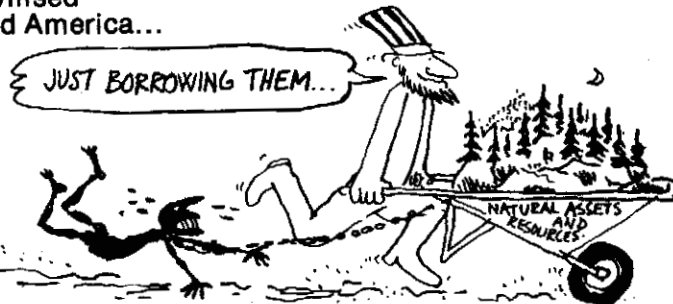


TO CUT A LONG STORY SHORT...

electricity arrived at the end of the 19th century and with generous helpings of oil and coal the industrialists steamed into the 20th hell-bent on bigger factories, better machines, deeper mines...and, of course, larger profits...

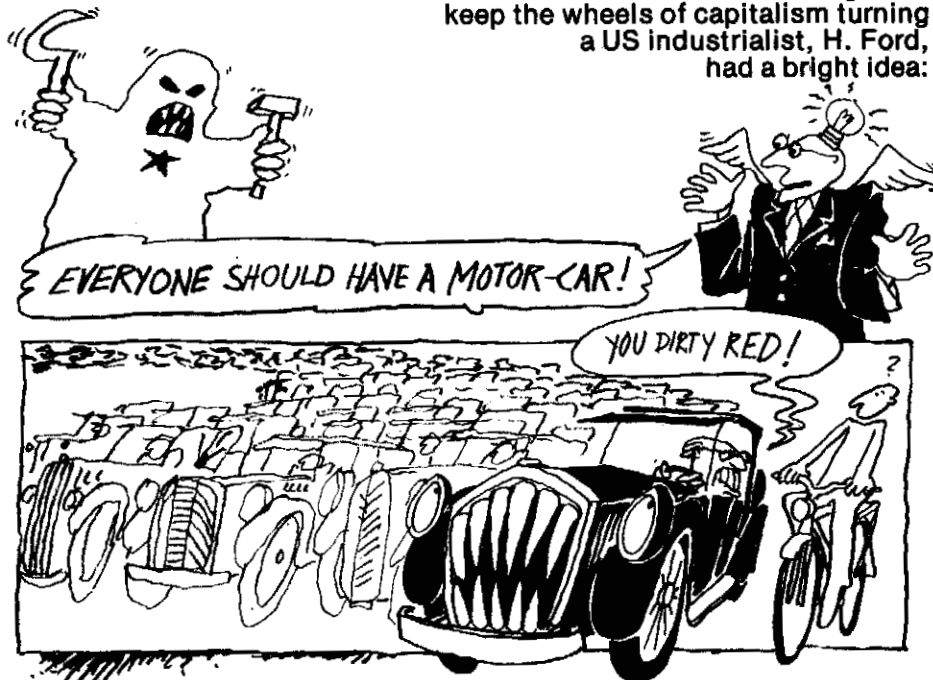
This was in the 'civilised' parts of Europe and America...

...the rest of the world paid the bill...



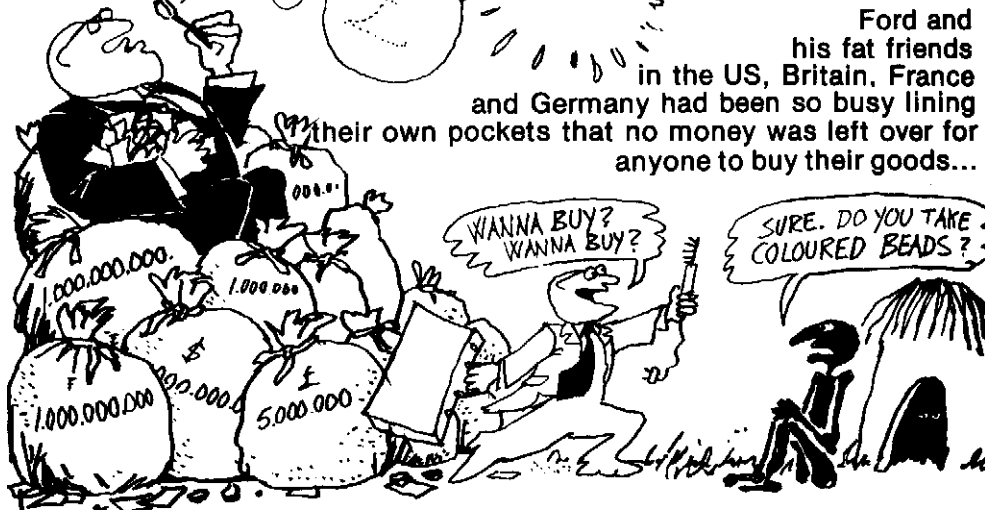
At the end of World War I the West lost a market, Russia going commie in 1917...

To divert attention from this breakthrough and keep the wheels of capitalism turning a US industrialist, H. Ford, had a bright idea:



At the start of
the 1930s...

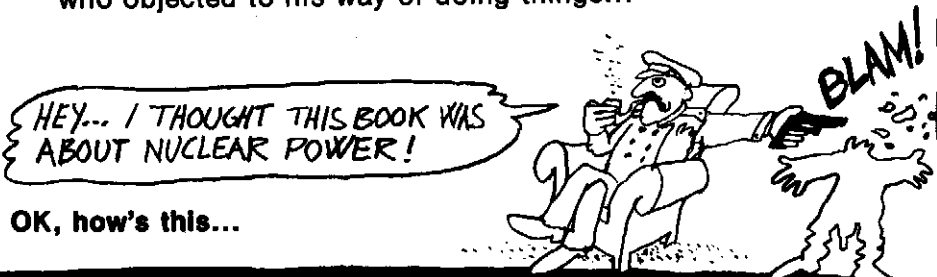
THE BUBBLE FINALLY BURST



Ford and
his fat friends
in the US, Britain, France
and Germany had been so busy lining
their own pockets that no money was left over for
anyone to buy their goods...

They closed down their factories and banks and ran for the
hills...leaving some 40 million people jobless, penniless and
bitter...and laying the ground for fascism and World War II...

Having already kicked out the capitalists, the Soviet Union
escaped this Great Depression...but it was having troubles of
its own, with Crazy Joe Stalin wiping out millions of peasants
who objected to his way of doing things...



OK, how's this...

**MEANWHILE, BACK
AT THE LAB...**



THIS IS **CHAPTER 2.**

In which the atom is split by mistake, some 200,000 Japanese are killed on purpose, Sam & Ivan play in the sandpit and the Indians call everyone's bluff...

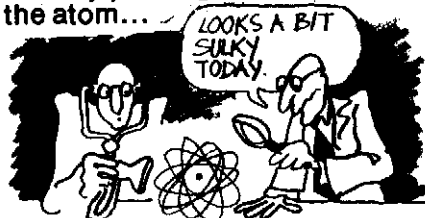


Scientist are funny people...

Give them an atom, tell them it's the smallest thing around and what do they do? Split it in two, of course. Just to rub it in, they'll split the very heart of the atom — the nucleus!

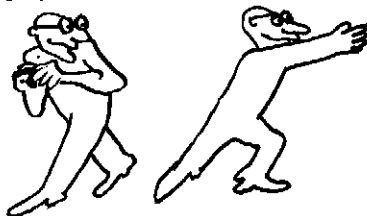


The scientists spent the first three decades of the 20th century probing the nature of the atom...



NIELS BOHR OF DENMARK **ERNEST RUTHERFORD** OF BRITAIN

By bombarding atoms with neutrons scientists found they could turn one chemical into another...and this became a favourite pastime in the labs of the 1930s...



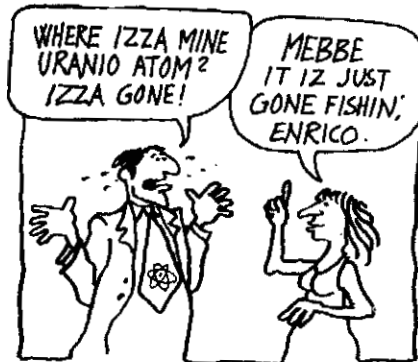
Among the most skilful neutron-tossers was the Italian Enrico Fermi...



Unlocking the atom, though, proved a tough nut until a Briton called **James Chadwick** discovered a tiny particle in 1932 — the neutron...



One day they tried bombarding the nucleus of a uranium atom...
and it disappeared! Something was up...



In 1939 an Austrian physicist, Lise Meitner, rescued the scientific community from going crazy by suggesting the uranium atom had *split* in two...a process she called **FISSION**



Ms Meitner's decisive role in this historic achievement was rewarded with a Nobel Prize...for her ex-partner Otto Hahn!

A fission reaction

1)

A neutron hits the nucleus of a uranium atom...

2)

OHMYGOD...
...the nucleus absorbs the neutron but becomes unstable...

3)

BANG!
...and splits in two, releasing some energy + 2 or 3 new neutrons...

THINK I'LL SPLIT ELSEWHERE

The release of fresh neutrons opens up the prospect of a CHAIN REACTION...

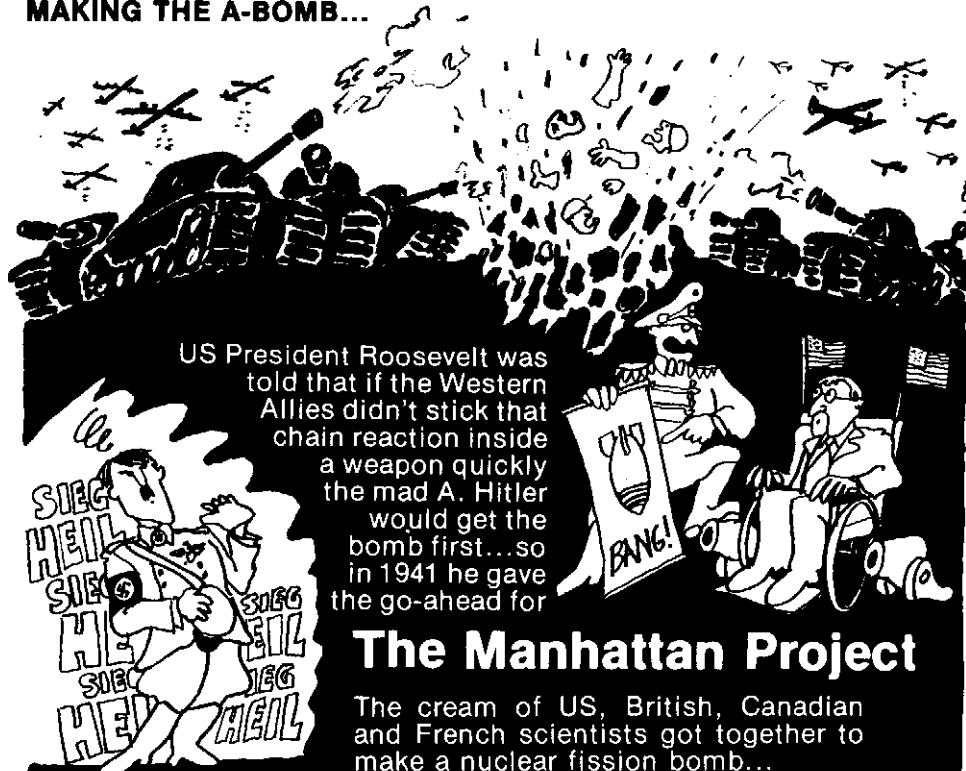
One neutron fissions one uranium atom, releasing two neutrons that can produce two more fissions, releasing four neutrons etc etc...

The fissions occur every 50-billionth of a second so a lot of energy is released very rapidly...

**BY NOW
WORLD WAR II
WAS JUST AROUND
THE CORNER AND
A NUMBER OF
SCIENTISTS
REALISED
THEY HAD THE
MEANS TO CREATE
A**

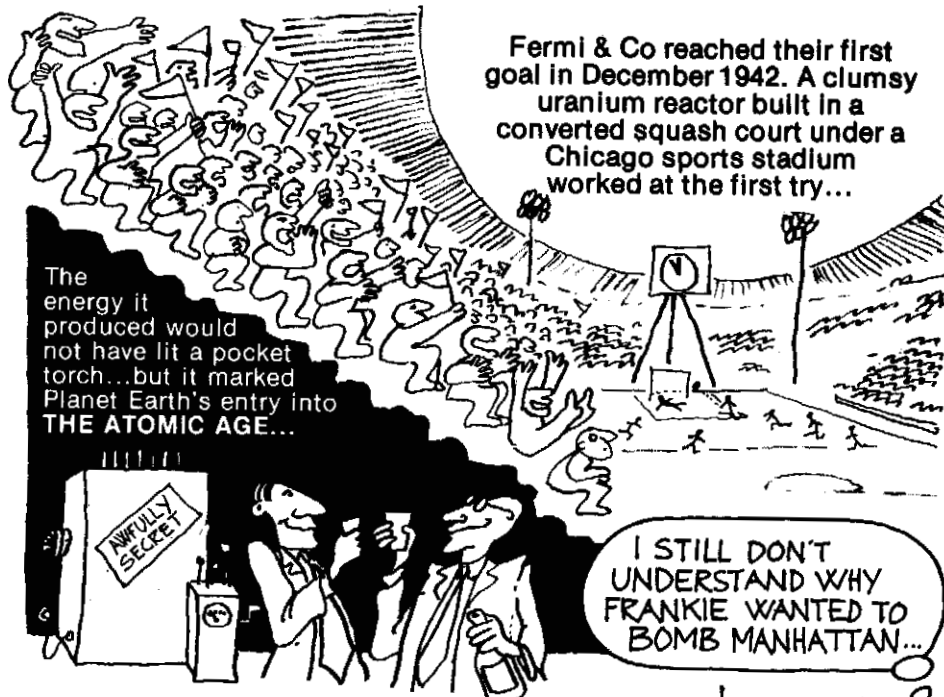
BIG BANG

MAKING THE A-BOMB...



Fermi, the Italian whizz kid, played a key role. Some have called him "the greatest physicist of the century". Others remember his stock response when colleagues muttered about the A-bomb posing a threat to humanity:

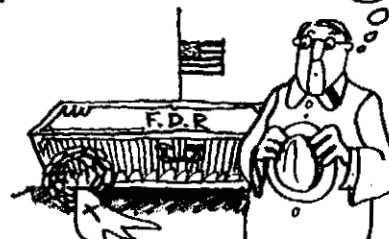




Fermi & Co reached their first goal in December 1942. A clumsy uranium reactor built in a converted squash court under a Chicago sports stadium worked at the first try...

The energy it produced would not have lit a pocket torch...but it marked Planet Earth's entry into **THE ATOMIC AGE...**

By now US scientists had turned up another fissionable element that was even better than uranium for making bombs... **PLUTONIUM...** one of the deadliest substances ever created by Man.



Over the next couple of years the bomb materials — plutonium and *enriched* uranium — slowly mounted up ...the project was so hush-hush that Harry Truman didn't even know about it when he took over the presidency on Roosevelt's death in 1945...

A New York journalist who nosed up evidence that nuclear energy could make an almighty big blast discovered later that his articles had been classified top secret — after publication.



By the time they were ready to test, in July 1945

some of the scientists were having serious doubts about the morality of a nuclear fission bomb. But they were outnumbered. The test, at **Almagordo** in the New Mexico desert was a shattering success and terrified some of the bomb's creators. Asked to describe what he'd seen, one physicist replied: "I can't tell you, but ...

DON'T EXPECT TO DIE A NATURAL DEATH!

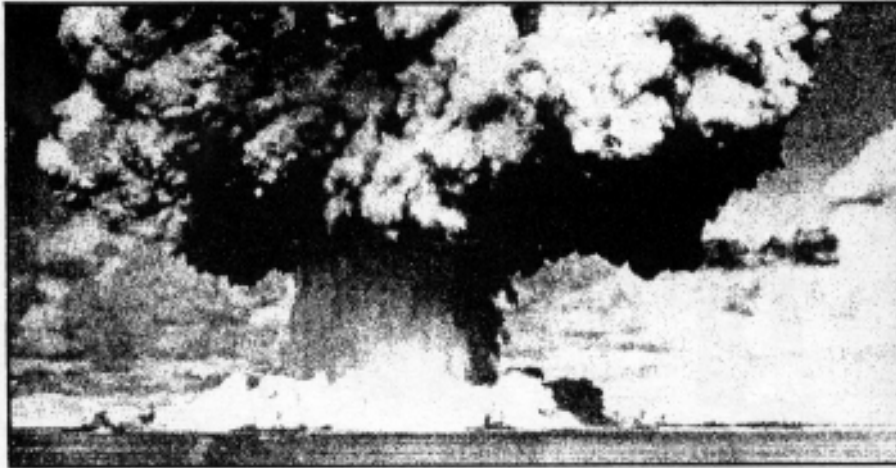


The Manhattan Mob lost no time in demonstrating to the world how greatly they'd improved the human race's capacity to destroy itself...on August 6, 1945, a uranium bomb nicknamed *Little Boy* was dropped on the Japanese city of Hiroshima. It worked and the war

was as good as over...

But the boys back home were anxious to try out their plutonium bomb as well...

So three days later *Fat Man* was dropped on the city of Nagasaki... That one also worked.



The two raids killed some 200,000 people immediately. Another 100,000 died from the after-effects of radiation over the ensuing decades. Today, victims of **Little Boy** and **Fat Man** are still dying in Japan at the rate of 2,000 a year... .





World War II came to an abrupt end...
The development of nuclear weapons did not...
The US Navy was sulking because
the US Army had gotten all the
glory for outstanding services
to mankind at Hiroshima and
Nagasaki...

The marines
needed
to
restore
their
manhood...



So in the summer of 1946
they arranged for 42,000
spectators to witness two bangs
at a Pacific atoll
called Bikini...

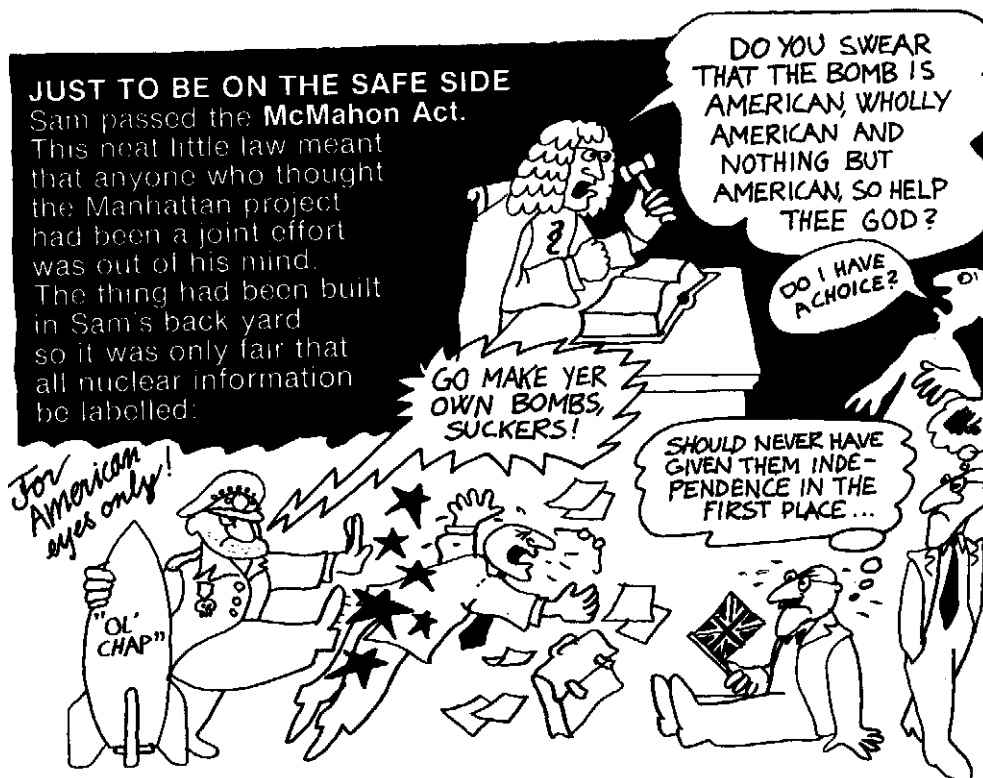


Absent from this display of
heroics were the local islanders...
they'd been secretly removed a few months earlier...
and could not return until 22 years later...by which time the
vegetation had become unproductive and the menu was
radioactive coconut crab...



MEANWHILE,

Back in the States, the
politicians and businessmen
were getting excited. Uncle
Sam was the only one in the
whole wide world with an
A-bomb! Time to spread some
Pax Americana around the
globe by gentle persuasion...
And not a moment too soon,
what with the weirdo commies
fanning out in Eastern
Europe and the **Yellow Peril**
going red in China...



The **British**, of course, were absolutely furious...They still hadn't got over the way the bloody Yanks had taken all the bloody credit for winning the bloody war...Now Sam was showing them the nuclear door! They stormed home in a huff to build their own bangs...



The **Canadians** were so upset they decided not to make any bombs at all...



So the stage was set
for the United States of the World...
or so it might have seemed to some...
Then Ivan's Gang went and spoiled

everything by
testing a fission
bomb of their own in
September 1949.
It was six times
bigger than
Little Boy...



Now it was common knowledge that no goddam
Russky could get the better of Sam except by cheating.

Scapegoats were soon found —
a couple called Rosenberg
who were accused of slipping
Ivan the secret formula...
In the thrill of a trial and
execution most people
overlooked
the fact that the
'secret formula' had long
been in general circulation in the scientific community...and that
Ivan had been fully engaged in nuclear research since 1940.

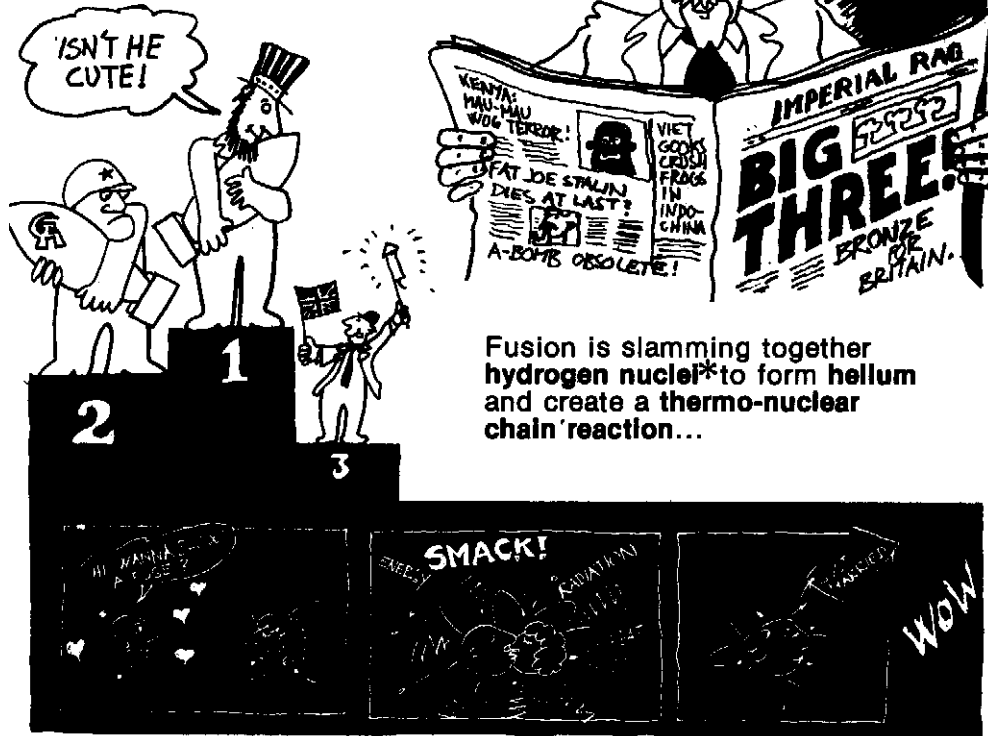


The Soviet mushroom launched
the Arms Race...also known as
The Sandpit Syndrome...



In October 1952 Britain's military scientists stopped sulking long
enough to blow the fish out of the water outside Australia...

London newspapers started tossing around phrases like **The Big Three...** but no-one was really fooled... fission bombs were kid's stuff by now and the two superpowers were working on superbombs combining fission with fusion...

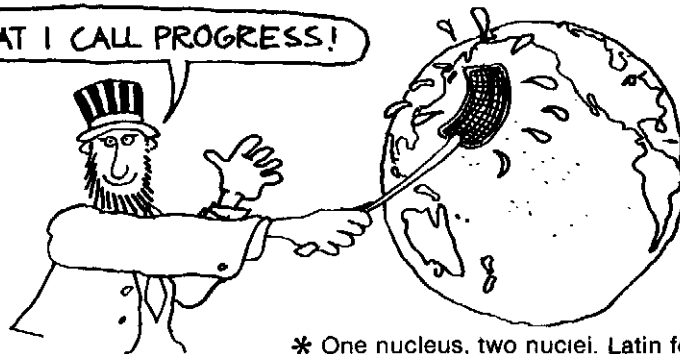


Fusion is slamming together hydrogen nuclei* to form helium and create a thermo-nuclear chain reaction...

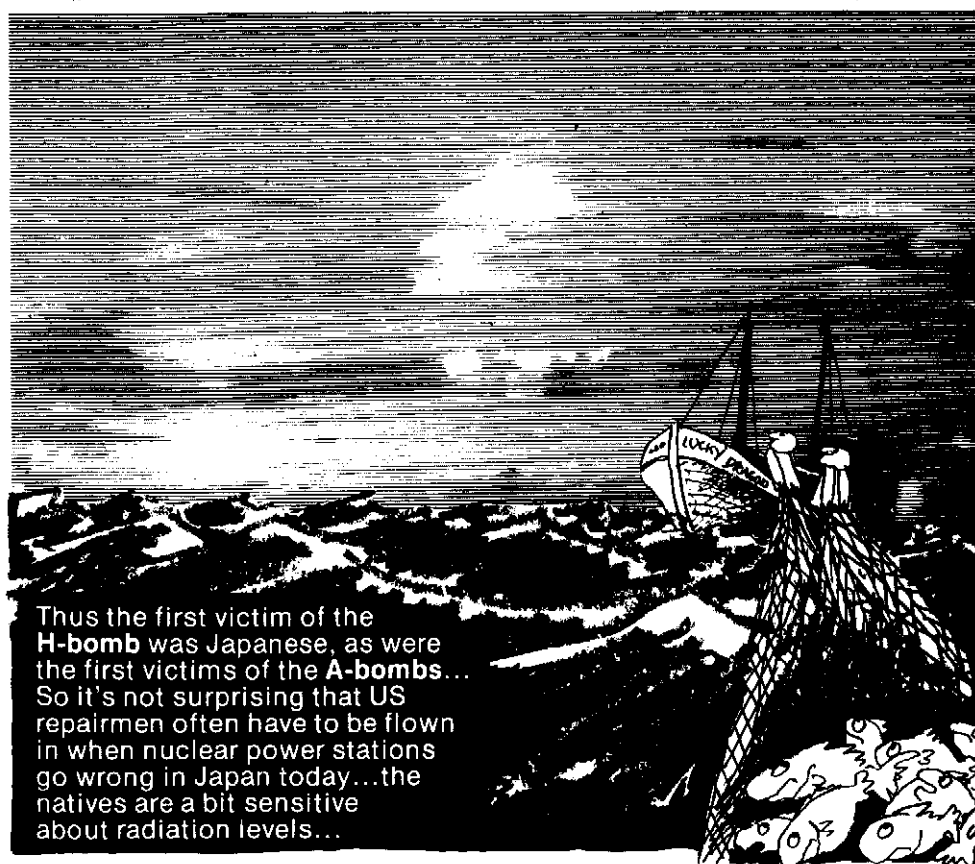
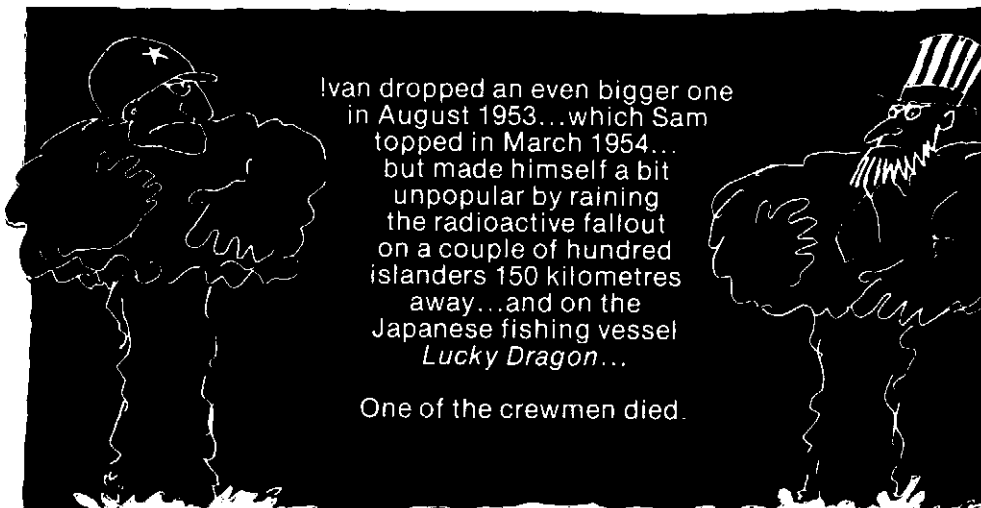
Whereas the fission bomb could destroy cities the H-bomb could destroy whole regions.

NOW, THAT'S WHAT I CALL PROGRESS!

Sam gave it a ground run in November 1952, wiping a Pacific island off the map with a blast 500 times bigger than Hiroshima...



* One nucleus, two nuclei. Latin form Ask any of the old Romans.



MEANWHILE,

Sam was at war again — disguised as a United Nations soldier — trying to win Korea for the Free World... Leading the charge was World War II hero **General MacArthur**, who was so keen on liberating the place that he asked for atomic bombs...

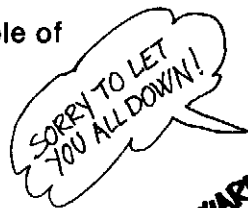
President Truman didn't think the idea sounded too bad...but he was talked out of it by his mates at the UN...and Mac lost his job...



Anxious as ever to play with the big boys, Britain let off an H-bomb in 1957...and over the next decade France and China tested atomic and hydrogen bombs to join the **Fission & Fusion Freaks...**

3-2 TO THE CAPITALISTS

Why stop at the H-bomb? What about a weapon capable of blowing the world to bits? Scientists have considered this tempting project... on the principle that the pursuit of truth knows no boundaries...but ruefully concluded that the **Doomsday Bomb** is a technical impossibility...



By way of consolation Sam's military boffins gave us:

THE NEUTRON BOMB



First tested in 1977, this delightful bit of hardware has one major advantage — **It does little damage to buildings...** It just spews out neutrons (*remember the neutrons?*) and kills all life within range...any survivors are thus spared the bother of building up a new production apparatus...

But we're getting ahead of the story...

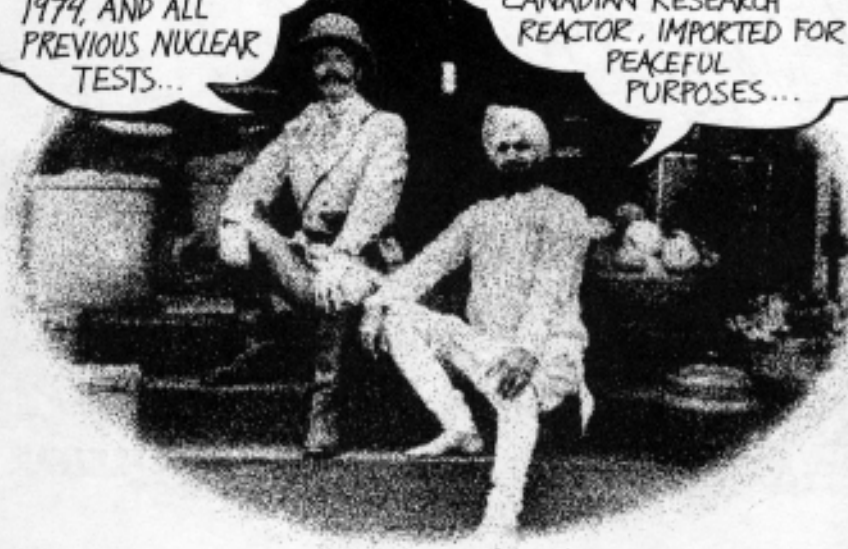
The Arms Race accelerated into the 1970s with Sam and Ivan battling for the lead, the Chinese a good third and the French and British gamely hanging on...

Suddenly out of nowhere came the Indians!



THERE WAS AN IMPORTANT
DIFFERENCE BETWEEN
INDIA'S PLUTONIUM
BOMB TEST, IN MAY
1974, AND ALL
PREVIOUS NUCLEAR
TESTS...

WE WEREN'T SUPPOSED TO
BE ABLE TO MAKE BANGS...
WE ONLY HAD A SMALL
CANADIAN RESEARCH
REACTOR, IMPORTED FOR
PEACEFUL
PURPOSES...

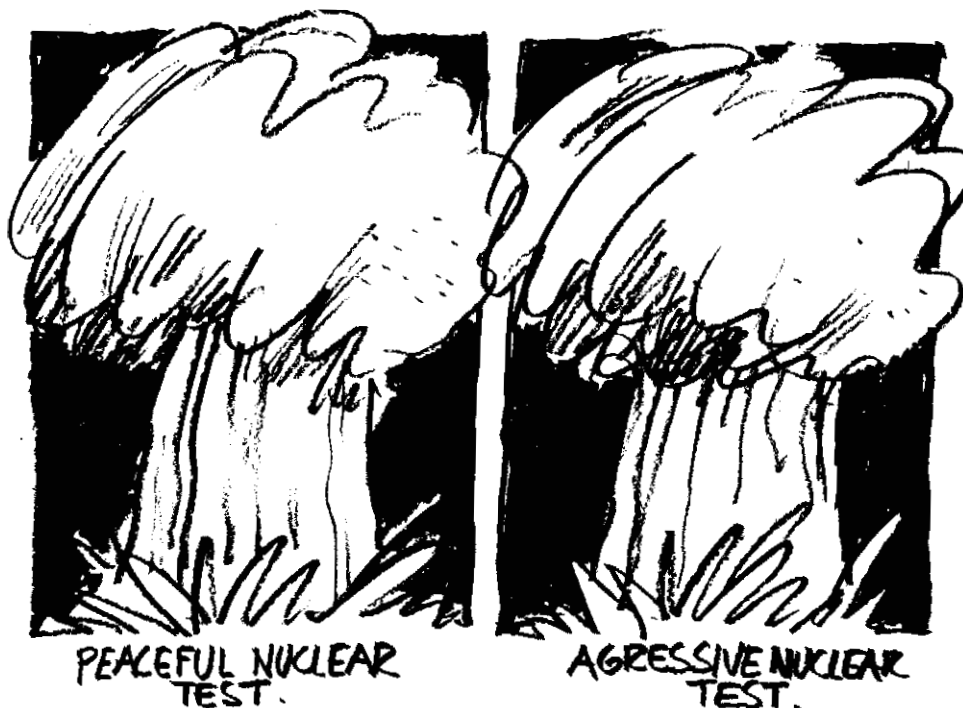


It was all terribly embarrassing.

For years we'd been assured by
the scientists
the military
the industrialists
the politicians

PEACEFUL NUCLEAR POWER CAN **NOT**
BE USED TO MAKE NASTY NUCLEAR
BOMBS! AND THAT'S FINAL!





**Had someone blown their cover 10 years earlier
things might have turned out differently...**

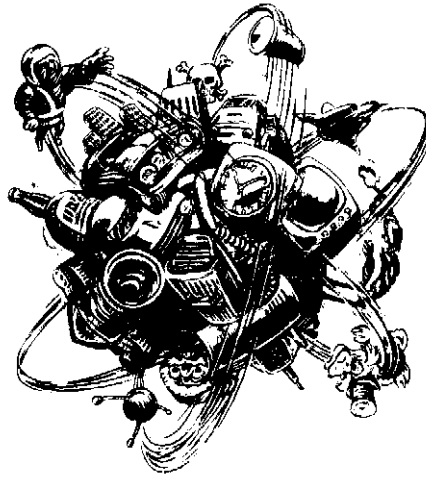
**But by the end of Indian Bomb Year more than 150 of those harmless
little nuclear power plants (*nukes*) were sprouting up around the
globe...**

**The 'exclusive' Nuclear Arms Club now looks like
getting a dozen new members during the 1980s...**



NOW ON TO **CHAPTER 3.**

In which «peaceful» nukes spread around the globe, the oil giants become energy giants, the Human Factor gets into his stride and accidents tend to happen...



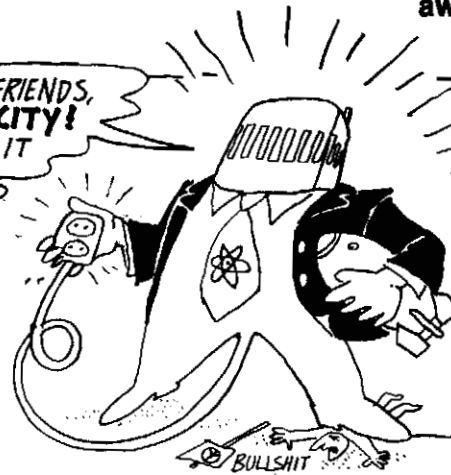
Originally the heat generated in the fission process was considered useless by-product...



But by the 1940s a lot of people realized that reactors were more than a way of producing plutonium

Some people got carried away

PLUGGED INTO YOUR GRIDS, MY FRIENDS, I PROVIDE **UNLIMITED ELECTRICITY!** CLEAN, HARMLESS AND SO CHEAP IT WON'T BE WORTH METERING.



To the European industrialists nuclear power sounded like a godsend. They were running short of cheap fuel just when a Second Industrial Revolution was in the offing. The fact that

nukes can only generate electricity and that electricity has limited industrial uses wasn't mentioned much



The military had seen the wheels in motion and was laying on investment in research and development of nuclear power...the capitalists had to climb aboard



Over at Sam's place private industry wasn't into nukes...there was plenty of cheap oil and the prospect of lots of coal and natural gas...

It quickly changed its mind when the **federal government** threatened to go into the business...



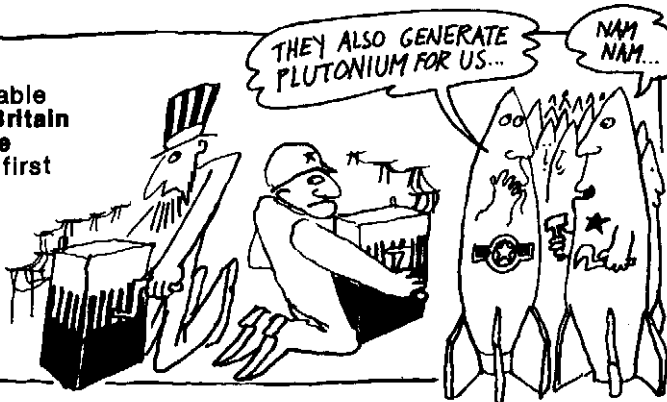
THOSE WHITE-HOUSE COMMIES HAVE GOT TO BE STOPPED!

Canada was the first country to concentrate on civil nuclear programmes...and, in 1952, the first to play host to a major accident. A research reactor at Chalk River exploded but no-one was killed so no-one got excited...



WE'RE PROUD TO ANNOUNCE THE FIRST INDOOR NUCLEAR EXPLOSION.

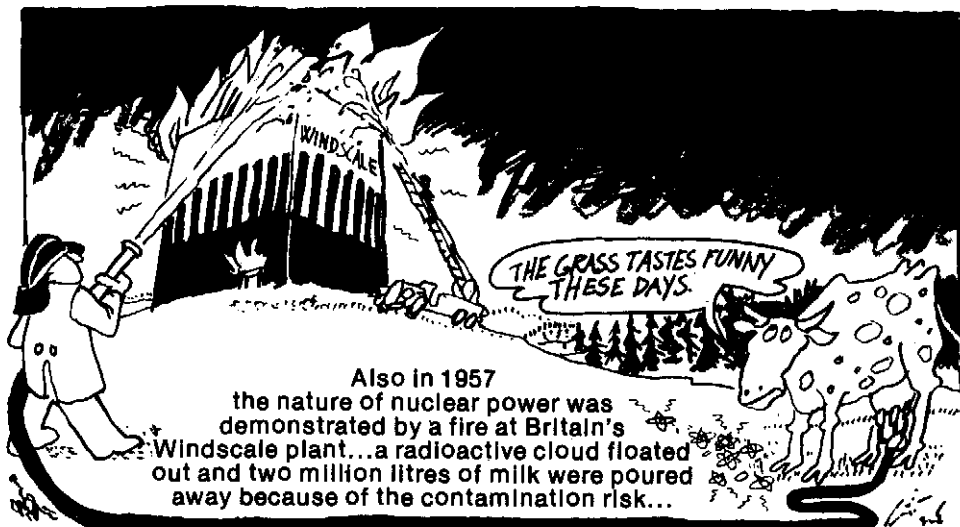
Sam & Ivan boasted sizable reactors by 1954...but Britain (Calder Hall) and France (Marcoule) claimed the first commercial nukes in 1956, generating electricity to the public...



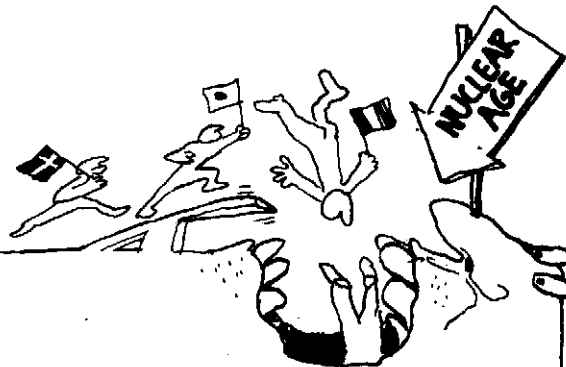
In the same year the International Atomic Energy Agency [IAEA] was set up in Vienna. It aimed to promote the spread of nuclear power and prevent the spread of nuclear weapons materials. Like teaching a child to walk then ordering it not to...

Sam took a short cut...in 1957 he called home the nuclear-powered submarine **Nautilus**, stole its reactor and set up the first US nuclear power station at Philadelphia...

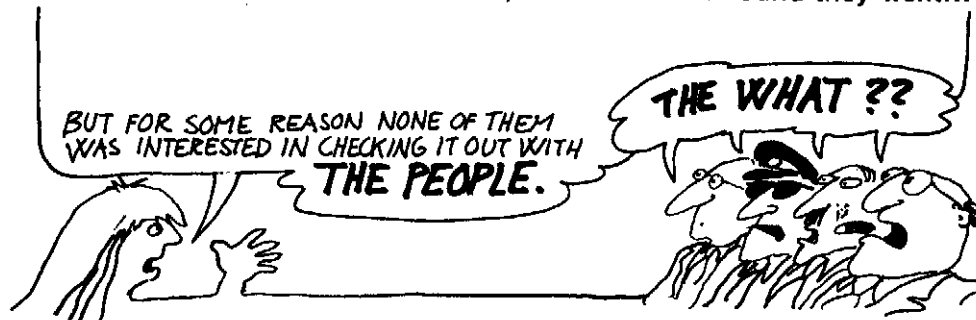




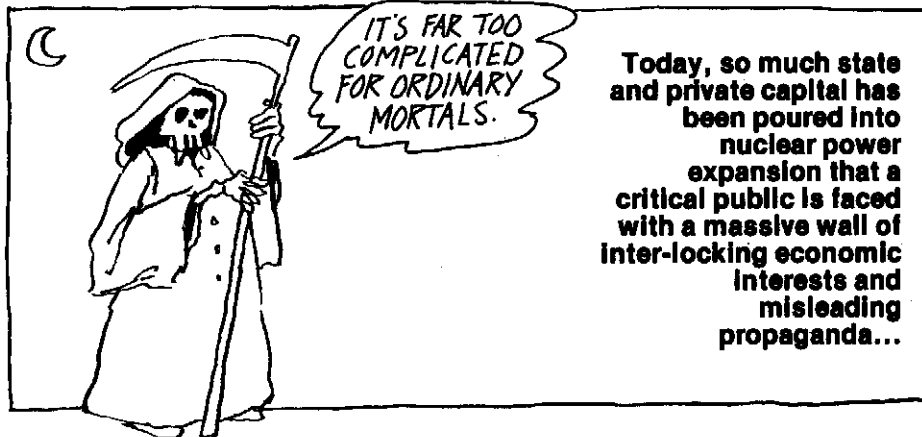
By this time, several countries *that did not have nuclear arms* were charging head-first into the nuclear age...West Germany...Canada...Italy...Japan...Sweden...



All the nuclear states had one thing in common — they'd taken the plunge without giving the general public a chance to express an opinion about nuclear power. The scientists had consulted the military, the military had consulted the politicians, who consulted the businessmen, who had a word with the scientists, and round and round they went...



In fact, not until 30 years after nukes made their appearance were the people of any country asked in any way whatsoever if they wanted this extremely dangerous technology...

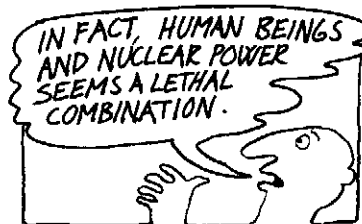


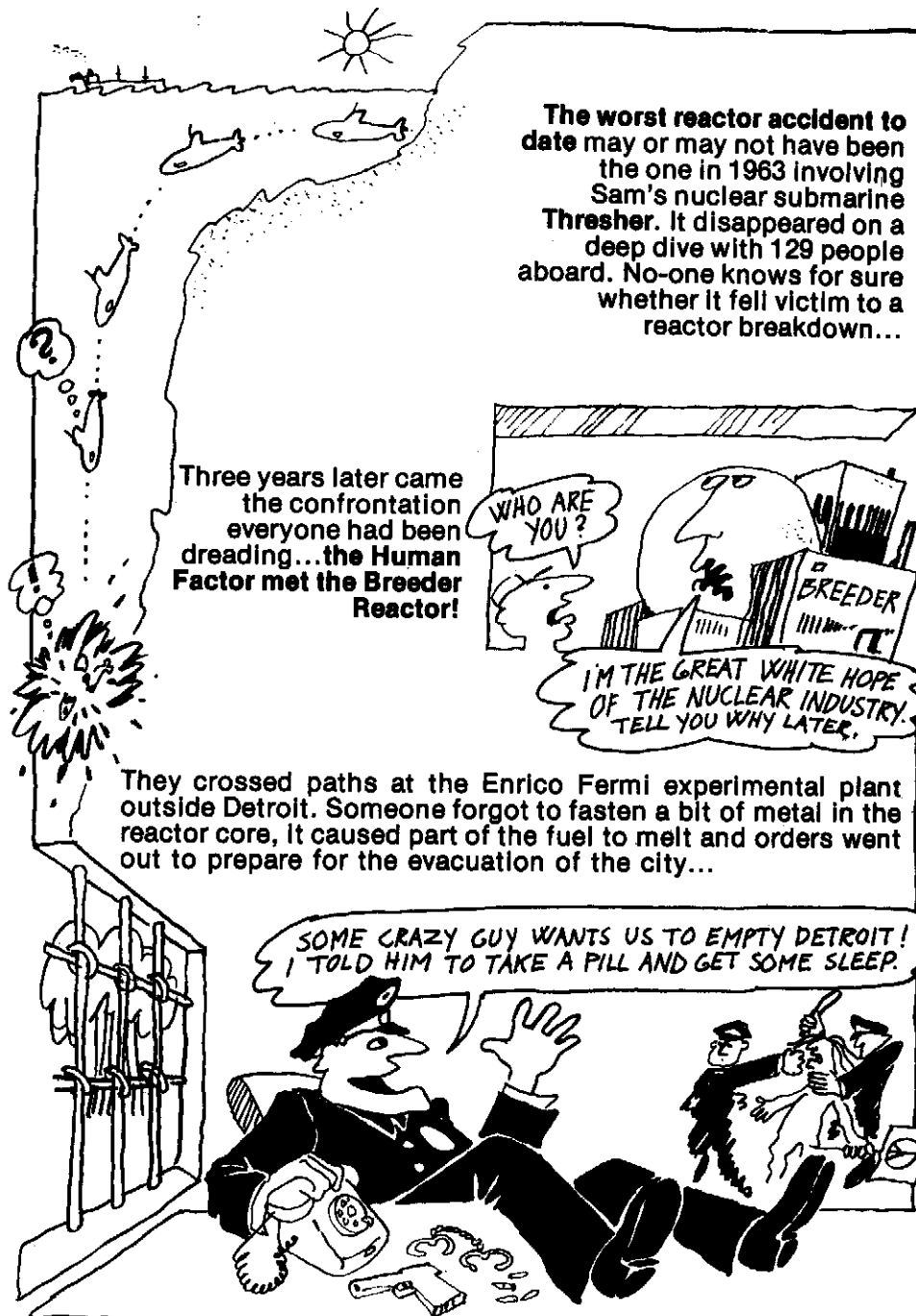
BACK TO HISTORY. The 1960s opened with a bang — at the Idaho Falls SL-1 nuclear plant in the US. Three repairmen were killed...

Their bodies were so contaminated by radiation that they couldn't be buried for 20 days...and then only in lead-lined coffins sealed in lead-lined tombs...



The accident was blamed on human error...as were the accidents at Chalk River and Windscale...and most of the mishaps that were to plague every major reactor design before the end of the decade!





The worst reactor accident to date may or may not have been the one in 1963 involving Sam's nuclear submarine Thresher. It disappeared on a deep dive with 129 people aboard. No-one knows for sure whether it fell victim to a reactor breakdown...

Three years later came the confrontation everyone had been dreading... the Human Factor met the Breeder Reactor!

WHO ARE YOU?

I'M THE GREAT WHITE HOPE OF THE NUCLEAR INDUSTRY. TELL YOU WHY LATER.

They crossed paths at the Enrico Fermi experimental plant outside Detroit. Someone forgot to fasten a bit of metal in the reactor core, it caused part of the fuel to melt and orders went out to prepare for the evacuation of the city...

SOME CRAZY GUY WANTS US TO EMPTY DETROIT! I TOLD HIM TO TAKE A PILL AND GET SOME SLEEP.

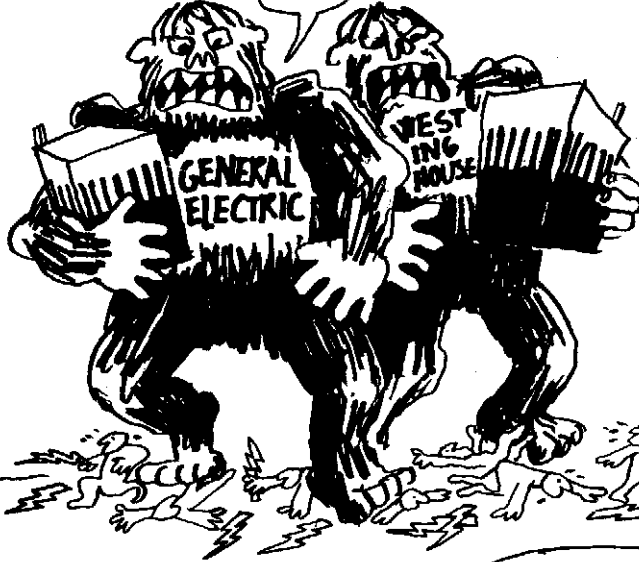
A disaster was averted...but only just. Had it occurred, claiming hundreds or thousands of lives, the development of nuclear power would probably have halted...or at least fast breeder development...

DON'T
COUNT
ON IT.



Instead, the second half of the 1960s brought an upswing in sales. Nuclear electricity was now looking profitable so Sam's heavies decided it was time to muscle in...

MOVE OVER
SMALL
FRY.



The giant US firms had got off to an early start so they were well placed to seize control of the western reactor market...and they still dominate today...

I MAKE MY OWN
NUKES AND
FLOG THEM TO
MY FRIENDS

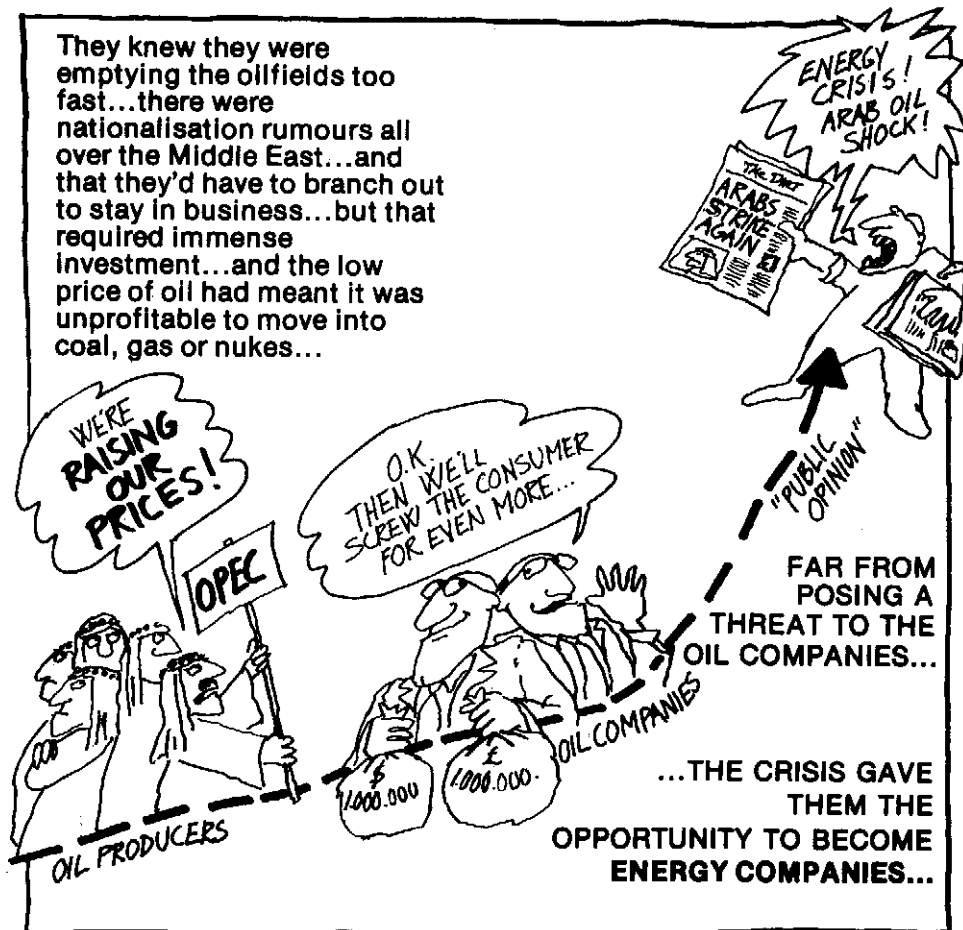


ANATOMY OF AN OIL CRISIS...

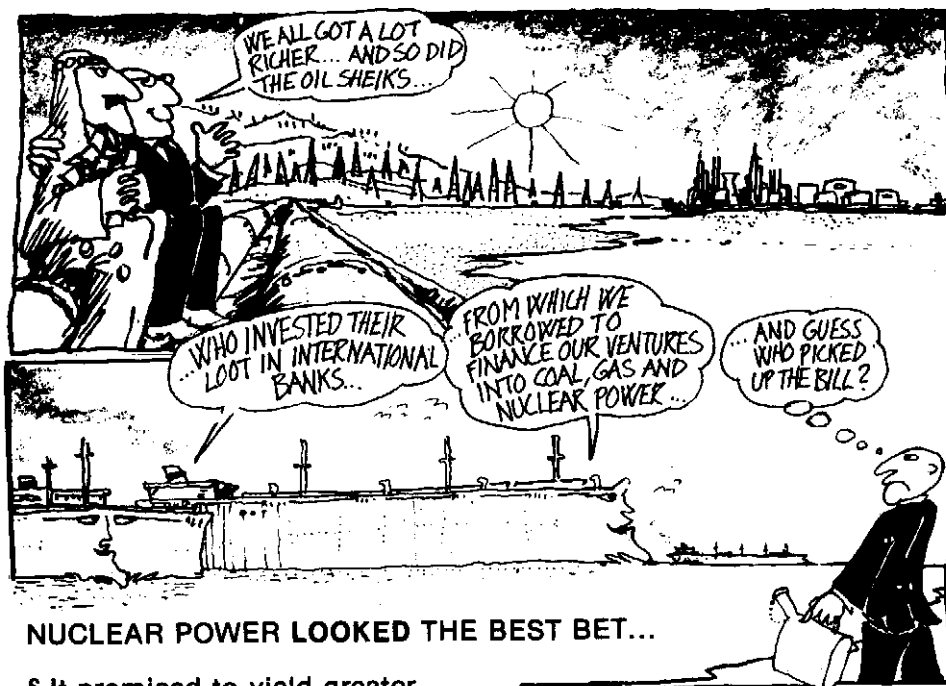
In 1973 the Arab oil-producing countries jacked up basic prices by 400%...and the 'black gold' that had fuelled the rapid industrial build-up of the West suddenly became 50% more expensive to the consumer...



They knew they were emptying the oilfields too fast...there were nationalisation rumours all over the Middle East...and that they'd have to branch out to stay in business...but that required immense investment...and the low price of oil had meant it was unprofitable to move into coal, gas or nukes...



UPSHOT OF THE OIL CRISIS...

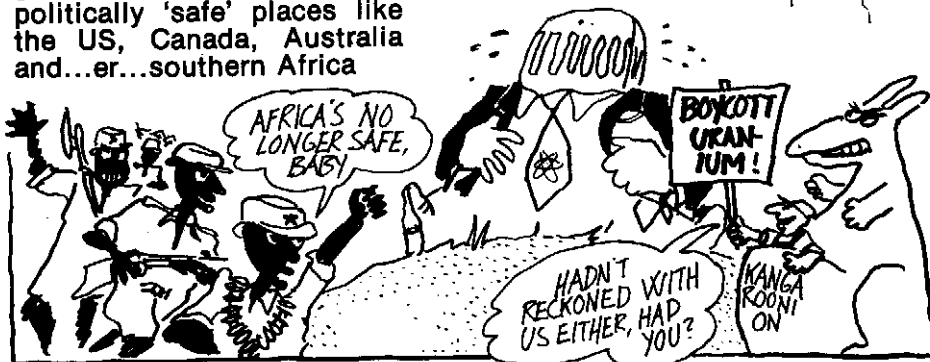


NUCLEAR POWER LOOKED THE BEST BET...

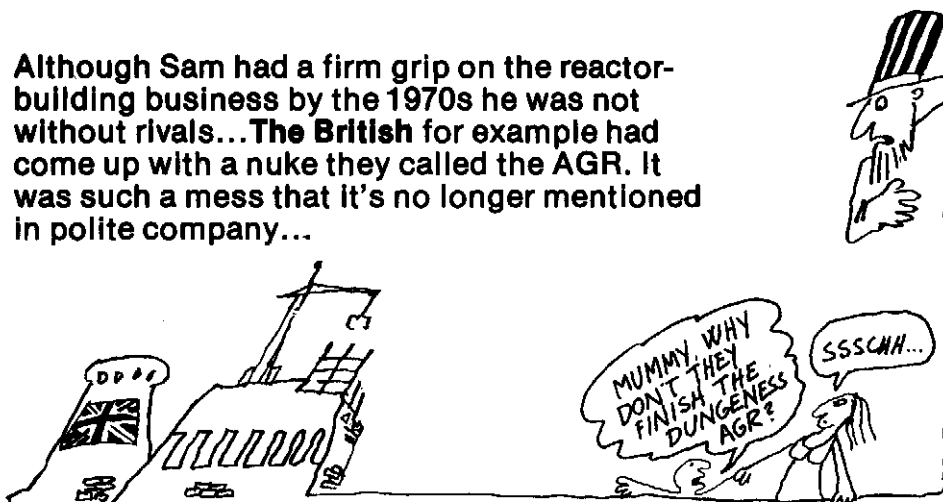
§ It promised to yield greater profits than coal

§ There was no union militancy in the nuclear industry ...while coalminers showed growing reluctance to die for the bosses

§ Uranium reserves were in politically 'safe' places like the US, Canada, Australia and...er...southern Africa



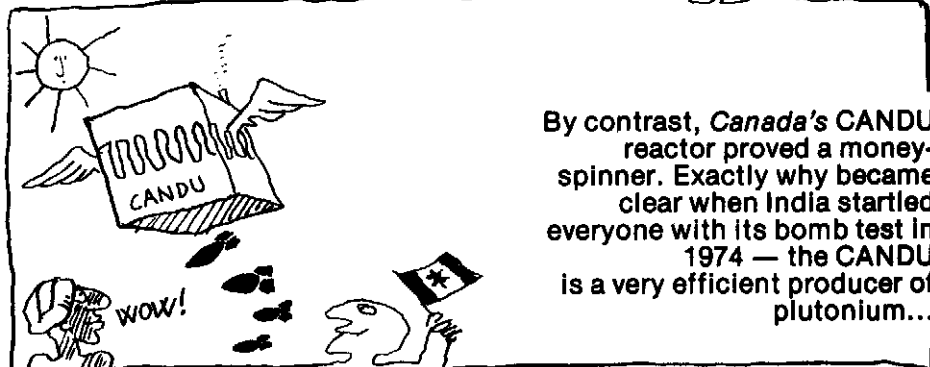
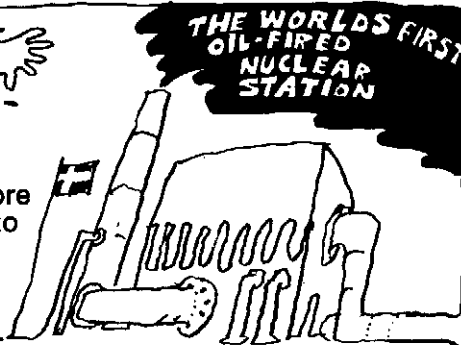
Although Sam had a firm grip on the reactor-building business by the 1970s he was not without rivals...**The British** for example had come up with a nuke they called the AGR. It was such a mess that it's no longer mentioned in polite company...



The Swiss also had a crack at making one...and wisely stuck it underground, at Lucens. After two years the core blew up and the reactor had to be scrapped...

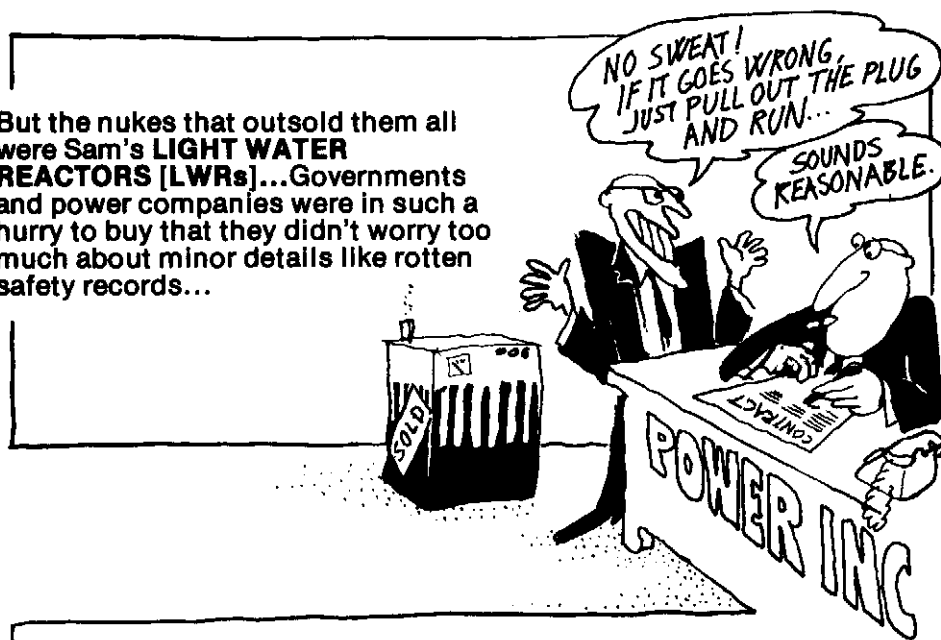


Sweden's first attempt was even more embarrassing...it couldn't be made to work at all! The plant, at Marviken, was refitted to run on oil...



By contrast, Canada's CANDU reactor proved a money-spinner. Exactly why became clear when India startled everyone with its bomb test in 1974 — the CANDU is a very efficient producer of plutonium...

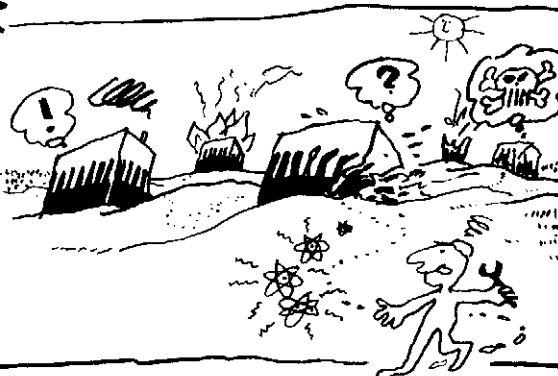
But the nukes that outsold them all were Sam's **LIGHT WATER REACTORS [LWRs]**...Governments and power companies were in such a hurry to buy that they didn't worry too much about minor details like rotten safety records...



The 1973 'oil crisis' had opened a lot of doors to the nuclear salesmen. By the mid-1970s there were 19 countries in the nuclear fold...among them two from the Third World...

THE HUMAN FACTOR

meanwhile, was having a gay old time...he fitted one reactor back-to-front, fitted pumps upside down in another, forgot a welding rig inside a third, lost track of uranium shipments and plutonium stocks, and shut down nukes left, right and centre...



THE HUMAN FACTOR'S

favourite toy was the LWR...

In 1975 he almost wrecked a couple at Browns Ferry in Alabama. A 7-hour fire knocked out emergency cooling in one reactor, closed down another and damaged hundreds of cables. The cause? A *candle* carelessly handled by an electrician...

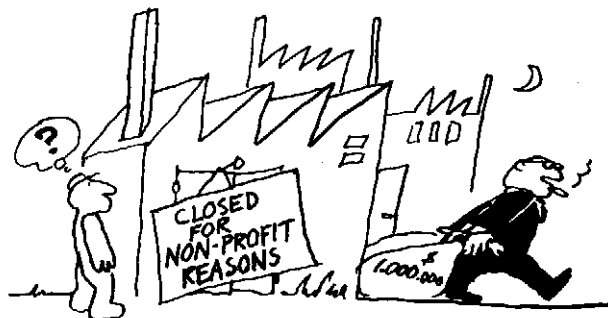


Despite the antics of HF the nuclear power industry predicted a dramatic worldwide expansion...with nukes in 40 or 50 nations by the end of the century meeting 50% of global electricity 'needs'...

...and the Fast Breeder just waiting to solve all our energy problems in the next century...



BUT SOMETHING WENT SOUR... In the second half of the 1970s a lot of people woke up to the dangers of nuclear power...and threw the whole future of the industry into doubt...





THE INDIANS HAD DEMONSTRATED THAT THERE WAS NO SUCH THING AS A **PEACEFUL ATOM**... BUT THAT DIDN'T WORRY THE INDUSTRY.

THE CLAIM THAT NUKES WERE RELIABLE AND SAFE RANG INCREASINGLY HOLLOW WITH EVERY BREAKDOWN AND DISASTER... THAT **DID** WORRY THE INDUSTRY. A BIT...

BUT NUKES BEGAN TO LOOK LIKE A **BAD ECONOMIC INVESTMENT**, AND THAT **REALLY** UPSET THE INDUSTRY!

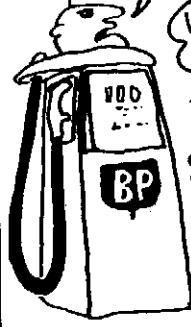


WHEN YOU'RE TRYING TO MONOPOLISE THE WORLD ENERGY SUPPLIES, HIGH RISKS AND LOW PROFITS ARE THE LAST THINGS YOU NEED!

In the US where half the world's nuclear trade goes on reactor salesmen suddenly found doors being slammed in their faces...and orders being postponed or cancelled. It was all too much for the major oil companies...

WHY DO YOU REFUSE TO PUBLISH SEPARATE ACCOUNTS FOR YOUR REACTOR BUSINESS?

WELL... ER... I'M JUST NATURALLY MODEST...



Shell, Gulf & Co started shedding their reactor interests...only Westinghouse of the big corporations claimed to be making a profit in the nuclear field...

PROFIT

In Japan and West Europe too...nuclear programmes are far less ambitious today than a few years ago...some western states have been scared off nukes altogether...while in Sweden a government lost office after 44 years to an opponent who pledged to scrap the nuke...

THE PROMISE WAS
BROKEN, OF COURSE...

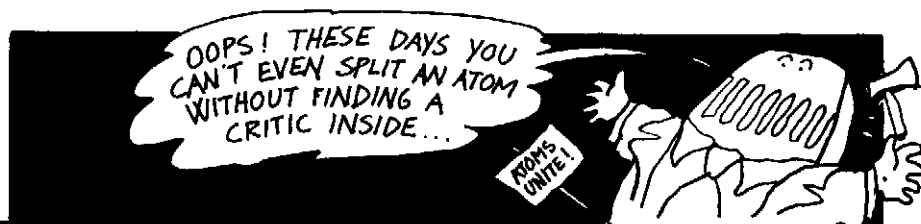
IN THE
BEST
PARLIA-
MENTARY
TRADITION.

As for Britain...home of the first 'commercial' nukes...the domestic industry hasn't sold a reactor since 1970 and looks in danger of collapse...



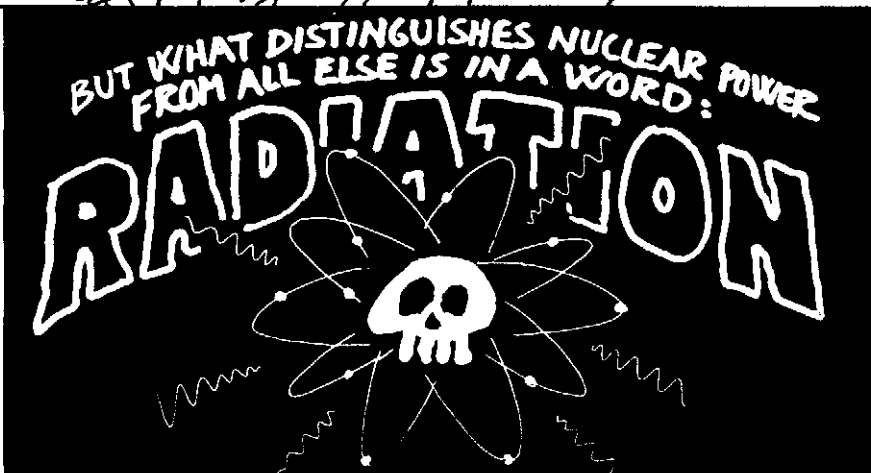
Everywhere, the evolution of a military-run industry into a civil one has brought enormous problems...technical, economic, political and moral...now the industry is on the defensive, hardly able to cope with its exposure to public scrutiny and the open marketplace...

AT MY PLACE, WE HAVE
NO SUCH PROBLEMS,
SO IT'S FULL
STEAM AHEAD.



OPPOSITION TO THE NUKE
has spread around the world faster
than the technology itself...

The objections to nuclear power are numerous...
some can equally well be levelled at the other
big-scale, centralised energy technologies like
coal and oil...



DON'T MISS CHAPTER 4.

In which the China Syndrome is explained, reactor cores are cooled or caught, Rasmussen puts our minds at rest and the Third World is ripped off once again...



THINK I'LL TAKE
SOME OF THESE
OUTFITS HOME
FOR THE WIFE
AND KIDS

WHAT IS NUCLEAR RADIATION, AND WHERE DOES IT COME FROM?

It's bursts of energy — sub-atomic fast-flying particles or high-energy electromagnetic waves — released when the nuclei of unstable (radioactive) atoms try to reach a stable state...

OK, BUT WHAT'S THIS GOT TO DO WITH ME?



Once inside your body these little beasts attack your cells... a direct hit on a gene can make your biological master-plan go haywire...in a word —**cancer!**

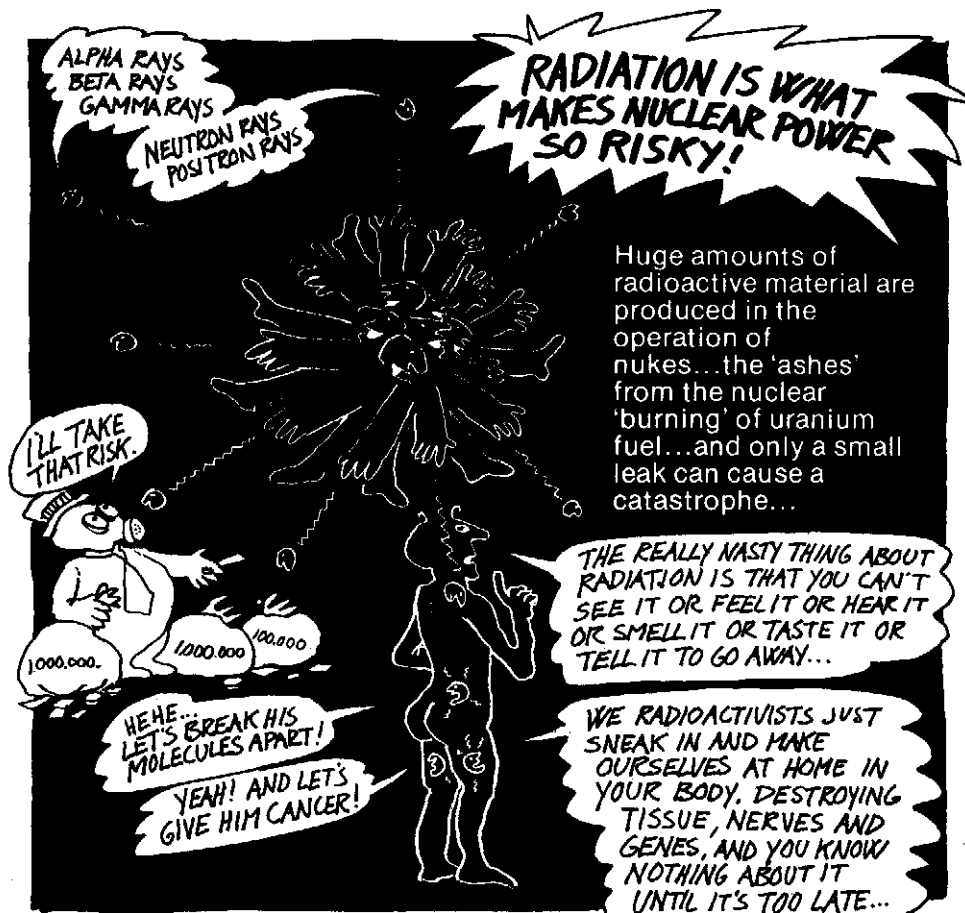
OOPS! NASTY. IS THERE MUCH OF THIS AROUND?

HEY! STOP THAT!

SO MUCH FOR PROGRESS THEN...

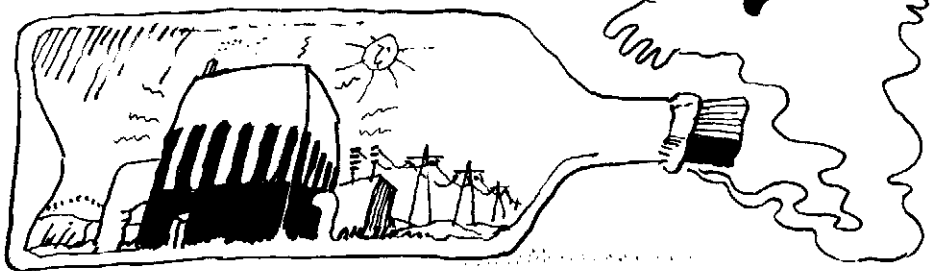
There used to be unstable atoms all over the place but by the time life evolved on our planet nearly all of them had calmed down...now nukes and A-bombs and things are turning the clock back millions of years...recreating lots of these immature, unstable young monsters...

RADIATION MAY BE A NATURAL PROPERTY OF MATTER, BUT IT'S BY NO MEANS A PART OF MAN'S NATURAL HABITAT. IN FACT: **IT'S DEADLY DANGEROUS!** ESPECIALLY FOR TINY CREATURES LIKE ME!

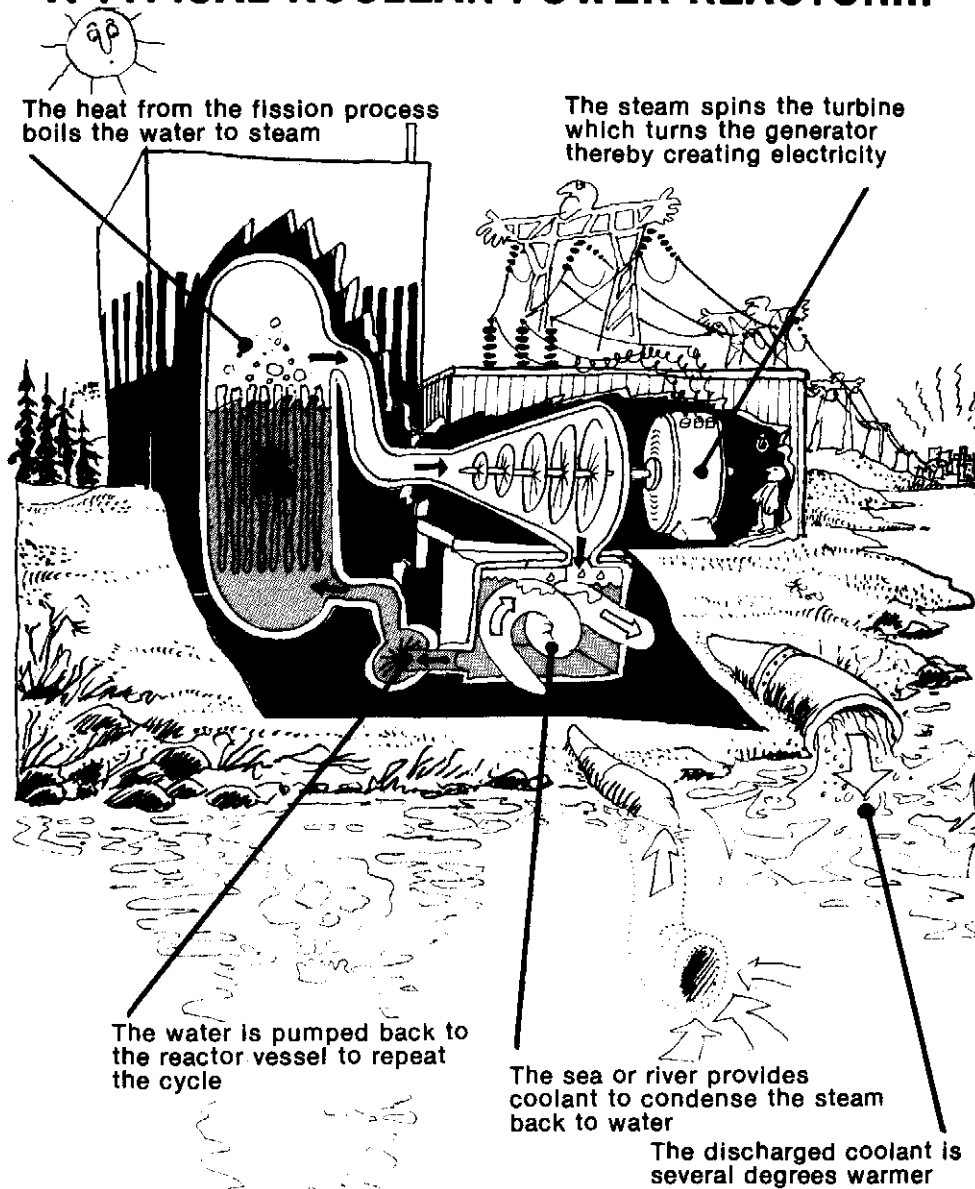


THE NUKE IS BOTTLED-UP RADIATION!

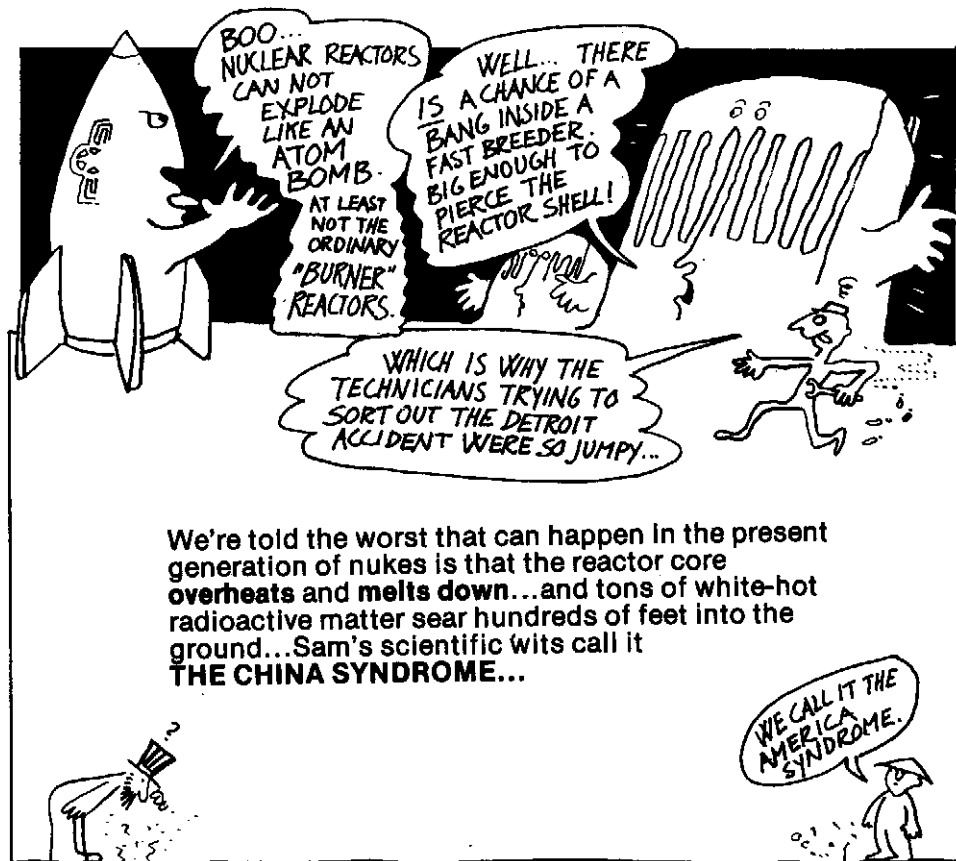
Were there any guarantee that it could be kept bottled up...after leaving the reactor as well...people wouldn't be making such a fuss...but there is no guarantee...



A TYPICAL NUCLEAR POWER REACTOR...

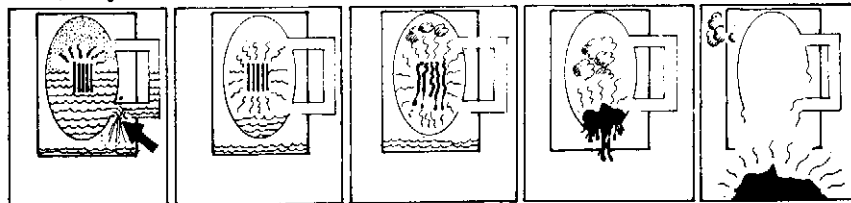


**ORDINARY POWER STATIONS WORK
IN THE SAME WAY EXCEPT THAT
THE WATER IS HEATED BY BURNING
OIL OR COAL...**



We're told the worst that can happen in the present generation of nukes is that the reactor core **overheats** and **melts down**...and tons of white-hot radioactive matter sear hundreds of feet into the ground...Sam's scientific wits call it **THE CHINA SYNDROME**...

NUCLEAR MELTDOWN



A main coolant pipe ruptures and the core temperature rises.

The fuel itself melts and the core fills with hot radioactive gases.

Steam explosions fling metal parts through the dome walls...while the molten uranium burns down into the earth.

The emergency cooling system also fails and the fuel rods melt.

The molten fuel burns through the pressure vessel and containment dome.

The most dangerous forms of radioactivity likely to be unleashed in a meltdown are the gaseous fission products. The exact consequences of such an accident — how many people would die how quickly — could only be established by a test run...

PERTH?
FOREIGN OFFICE
IN LONDON HERE...
HOW MANY
YOUR END?



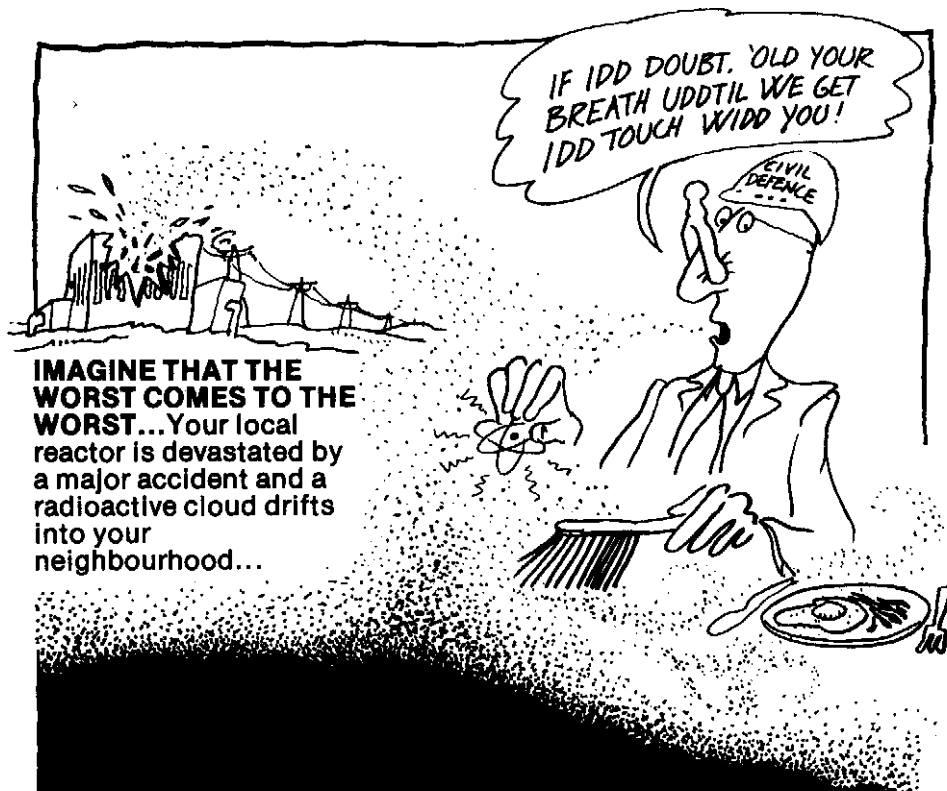
A key barrier between a meltdown and a public health disaster is the ECCS — the emergency core cooling system. There's a lot of evidence that it's less than totally reliable. Special hearings in 1973 turned up two dozen safety researchers from the US Atomic Energy Commission itself with misgivings about the ECCS...



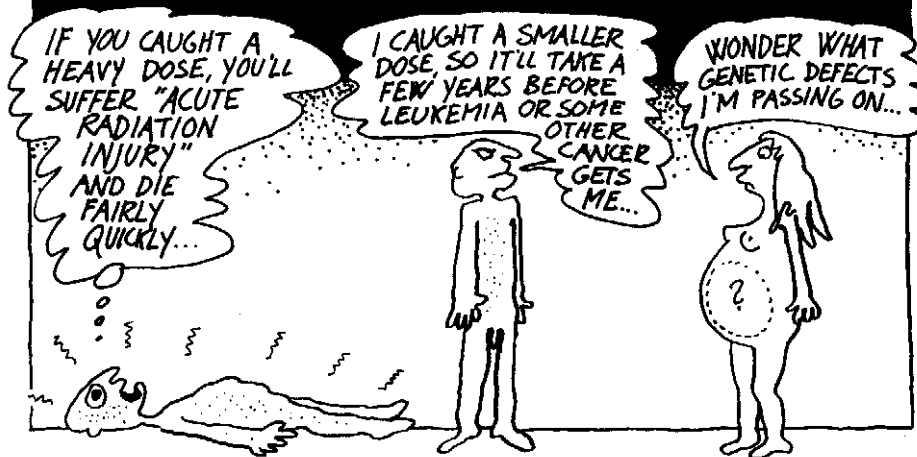
Of course the nuclear industry is fully confident that the ECCS is a safe back-up...so confident that it's developing 'core catchers' in case the ECCS fails. These are designed to disperse and cool the molten debris. The French are installing one beneath their massive Super-Phénix breeder at Malville...

EEZ AN OLD FRENCH
PROVERB: EEF YOU
CANNOT COOL ZEM,
CATCH ZEM.





Those invisible particles aren't good for you so your best bet is to leave. They can settle into your food, drink, building materials or anything else that's lying around...worst of all, though, is breathing them in...



HOW MANY OF US WOULD BE KILLED
IN A REACTOR DISASTER?
... AND WHAT ARE THE CHANCES
OF IT HAPPENING?

For years lots of busy little men
have been putting such
questions to their slide-rules and
computers. Depending on which
report you trust it seems that
between a dozen and tens of
thousands of victims could be
expected...



NOT WHERE I
COME FROM!

A test run would be useful to the
statisticians...but it might be
difficult to keep out of the
newspapers...

A major accident contaminating
a large area apparently took place
in the Soviet Union in 1958. Ivan
hasn't let on what happened. It
could have been a reactor
breakdown but most signs point
to an explosion of radioactive
waste buried underground...



The AEC's Rasmussen Report of 1975 came up with a reassuring 'worst-accident scenario'...

3,300 quick deaths
45,000 cancer cases
5,100 genetic defects
\$14,000,000,000 in property damage

RUBBISH! I'D SAY WE COULD BRING IT DOWN TO 10,000 MILLION DOLLARS.

THE REPORT IN ITS CURRENT FORM IS EITHER HIGHLY MISLEADING OR VIRTUALLY USELESS!

The report has been demolished by a number of qualified critics. The US Environmental Protection Agency — a federal body — put the death toll 10 times higher. Rasmussen neglected vital factors to such an extent that a Princeton physicist told a Congressional Sub-Committee



Rasmussen's models were two plants in the US...where the law says no more than 380,000 people may live within 25 kilometres of a nuke. But elsewhere the situation can be very different...for instance, Sweden's Barsebäck plant is smack in the middle of Scandinavia's most densely-populated area...

By the way

IN 1975 THE U.S. ATOMIC ENERGY COMMISSION FISSIONED INTO TWO ORGANISATIONS.

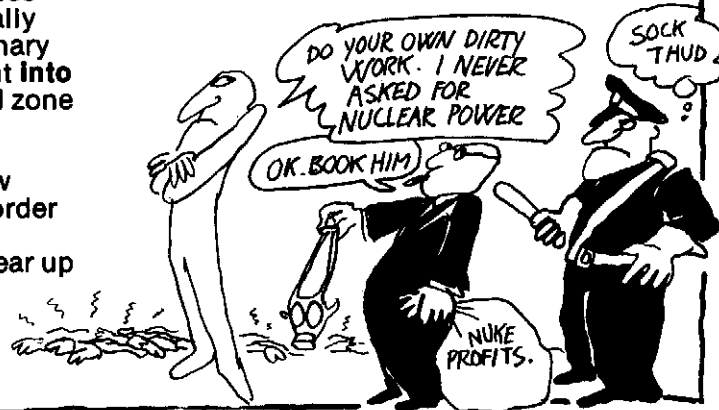
ATOMIC ENERGY COMMISSION

NUCLEAR REGULATORY COMMISSION
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Over a million Swedes and Danes live within 25 kilometres of Barsebäck and two million live within a 40 kilometre radius. The Danes have no nukes themselves and are naturally thrilled at the Swedes' willingness to involve them in the risks...



WHILE WE'RE ON THE SUBJECT... The Swedish authorities have democratically arranged for ordinary citizens to be sent into the contaminated zone in the event of disaster... a constitutional law allows police to order any able-bodied person to help clear up the mess...



Rasmussen decided the chances of a disastrous accident occurring were extremely remote...

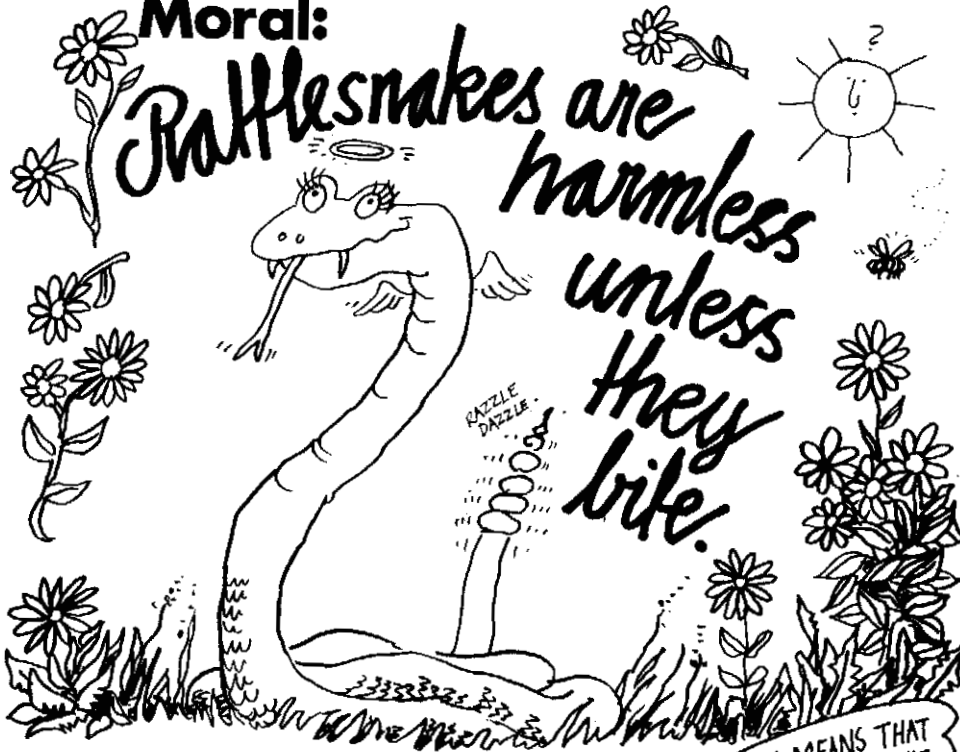
THERE WAS JUST AS MUCH CHANCE THAT A METEORITE WOULD HIT A U.S. CITY, HE SAID.

AND THE FOLLOWING DAY ONE DID?

No, but the Brown s Ferry accident was just the kind he was more or less ruling out...

Moral:

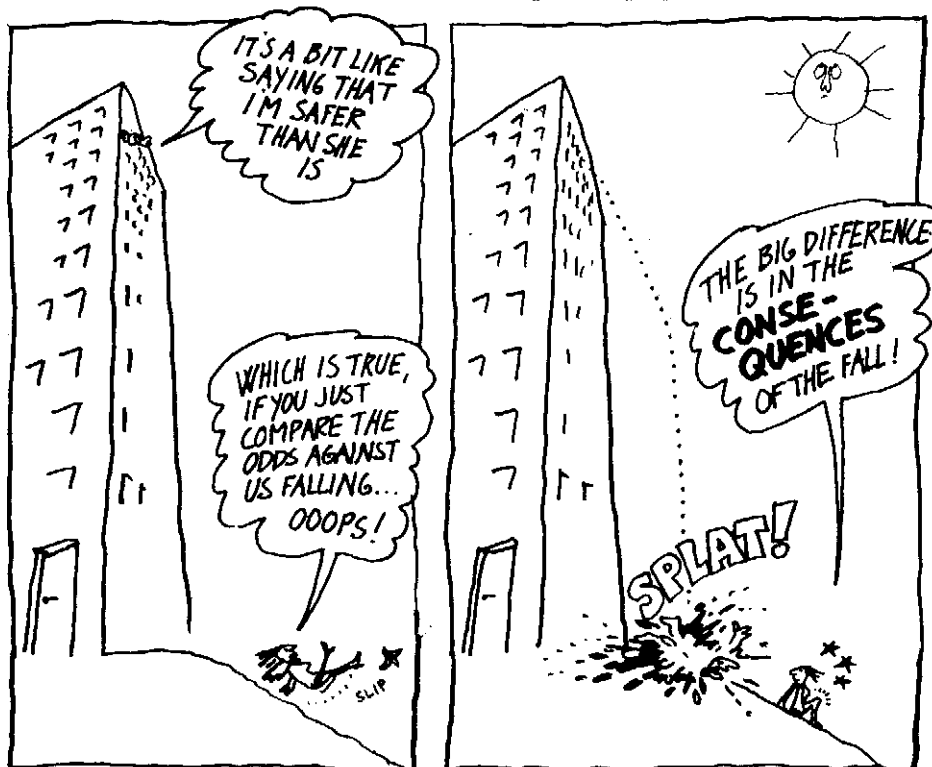
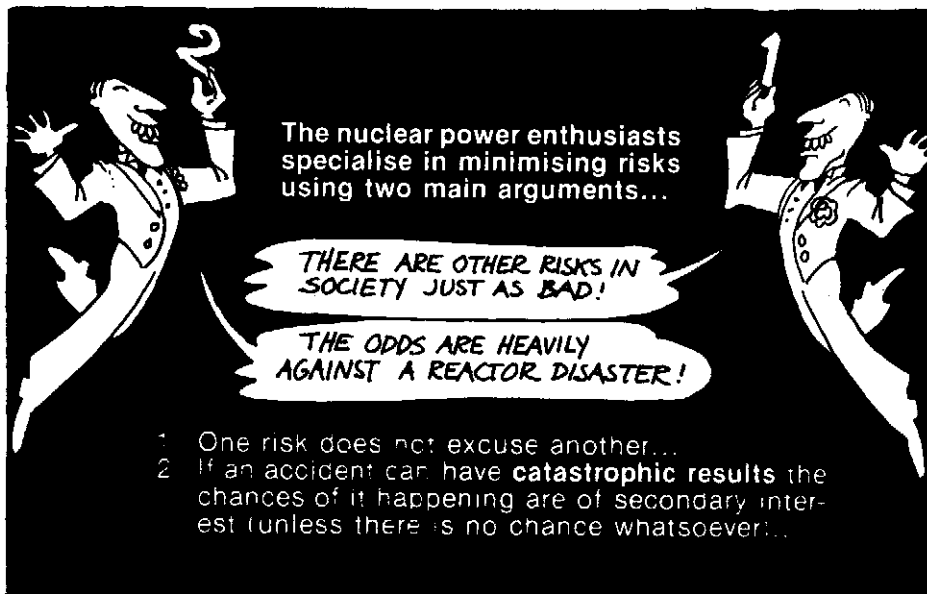
Rattlesnakes are harmless unless they bite.

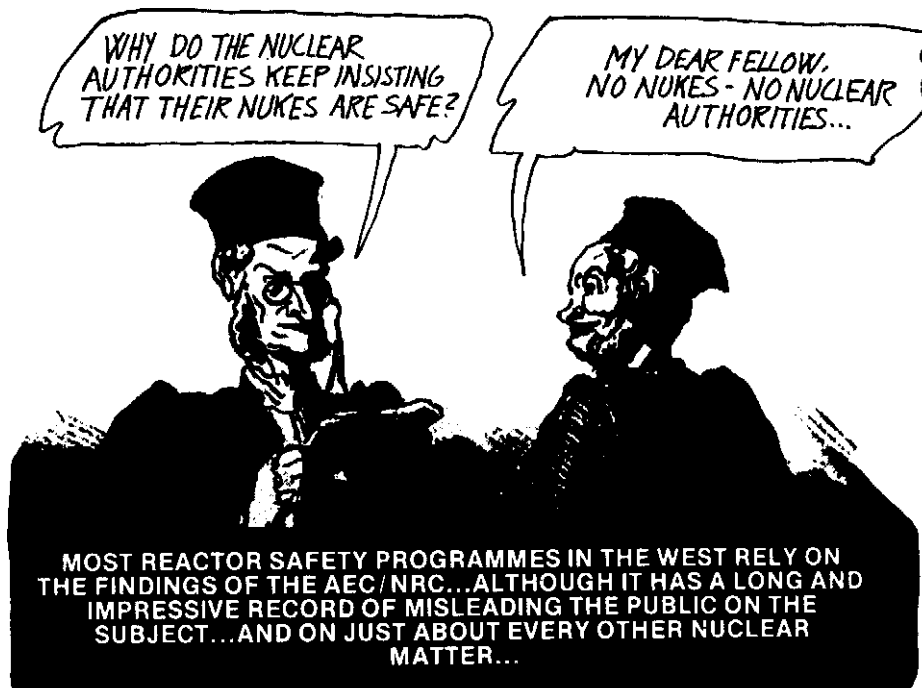


A later study by the Union of Concerned Scientists in the US put the probability of a nuclear plant catastrophe 100 times higher than Rasmussen...

WHICH MEANS THAT BY THE END OF THE CENTURY WE MIGHT BE HAVING SERIOUS ACCIDENTS EVERY SIX YEARS...







After the special ECCS hearings a Congressional Committee said the AEC had **'developed a serious credibility gap...by suppressing unwelcome evidence of danger and by demoting or firing researchers who have pushed their findings too seriously...'**

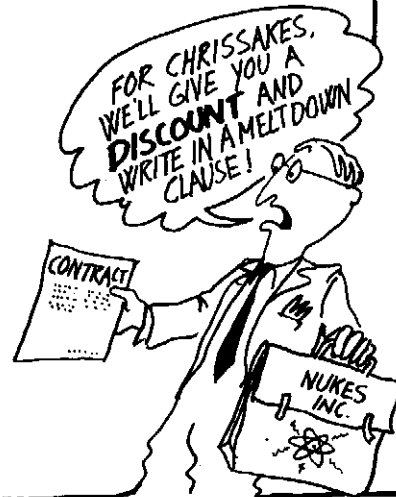
The New York Times studied 11 years of AEC documents and concluded that the agency **'repeatedly sought to suppress studies by its own scientists that found nuclear reactors were more dangerous than officially acknowledged or that raised questions about reactor safety devices...'**



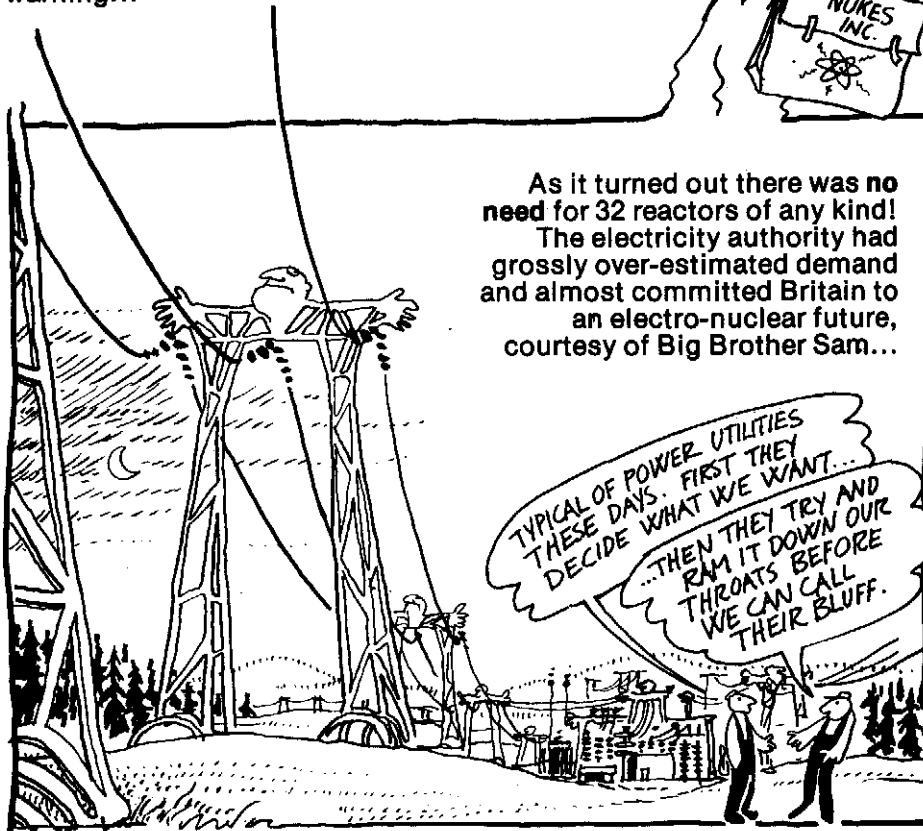
Leo Goodman, a union energy expert sometimes called the godfather of the anti-nuclear struggle in the US, put it more bluntly: **'AEC was dishonest and tricky from the word go...Watergate was nothing new to me...'**

FAR FROM BEING SAFE nukes have been besieged by problems from the outset...as pointed out in a 1973 AEC report which was suppressed until the environment group Friends of the Earth got hold of a copy...

The British among others have flatly rejected Sam's claims that his LWRs are safe...a programme to buy 32 of them was abandoned after the British government's Chief Scientific Advisor decided they could rupture without warning...



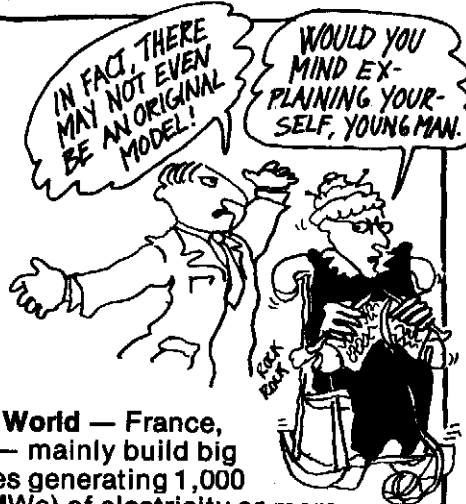
As it turned out there was no need for 32 reactors of any kind! The electricity authority had grossly over-estimated demand and almost committed Britain to an electro-nuclear future, courtesy of Big Brother Sam...



Operating nukes on home ground is a risky enough exercise ...exporting them to non-industrial countries is a recipe for calamity...



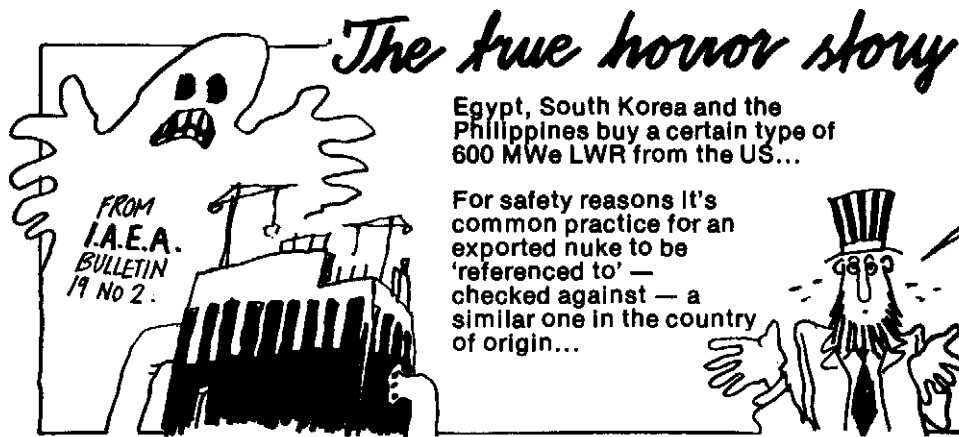
Reactors are a bit more than a source of heat in a bucket of water...they're very complicated...and when fully built the **exported** nuke may be very different from the **original** model in the supplier state.



The countries exporting to the Third World — France, West Germany, Canada and the US — mainly build big ones for the domestic market...nukes generating 1,000 Megawatts (MWe) of electricity or more...



O.K. SO YOU GET A SITUATION LIKE THIS...



of the nuclear rip-off:

BUT BECAUSE OF THE HOME DEMAND FOR **BIG** REACTORS, WE'VE NO CORRESPONDING MODEL FOR THEM TO REFER TO.

One being built in Puerto Rico was called off before completion...had it been finished it would have undergone systematic safety inspection and...

A NUMBER OF ALTERATIONS WOULD UNDOUBTEDLY HAVE BEEN MADE.



So instead the Egyptians, Koreans and Filipinos have to 'reference' their nuke to a similar one in Yugoslavia...which had been referenced to an earlier plant in Brazil...which in turn had been referenced to the abandoned Puerto Rican plant!



WELL, AT LEAST THAT LEAVES US PLENTY OF SCOPE FOR IMPROVISATION.



Important changes and modifications made in domestic nukes in the exporting states are not necessarily included in the nukes flogged abroad...



THE MAIN VICTIMS, OF COURSE, ARE THE IMPORTING COUNTRIES LACKING SAFETY REVIEW BODIES OF THEIR OWN.

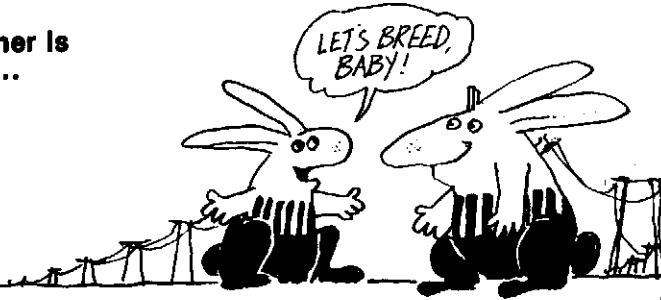


WHICH MEANS JUST ABOUT THE ENTIRE THIRD WORLD MAN!



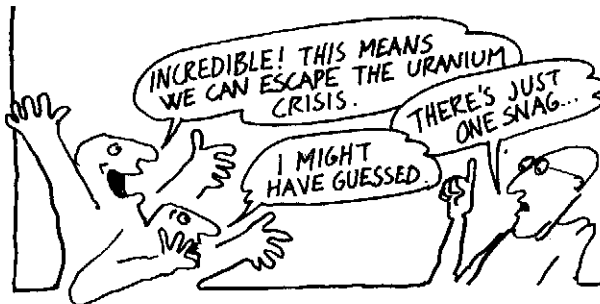
Just around the corner is
the next generation...

THE FAST BREEDER REACTORS



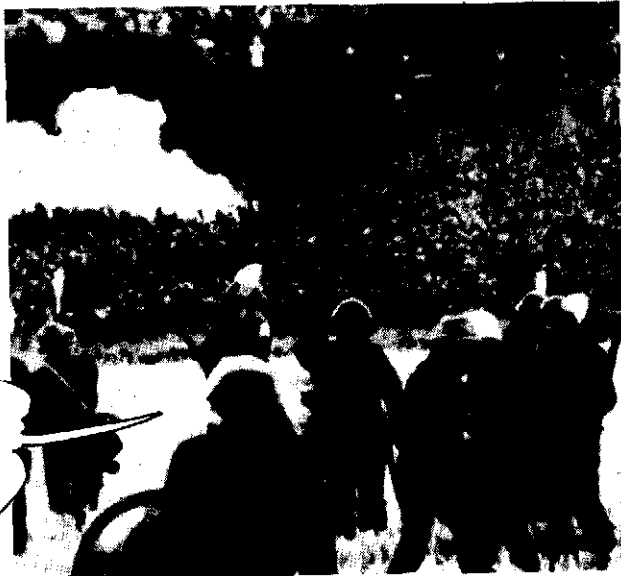
They're a bit different from today's burner reactors...

All nukes produce plutonium but only the breeders are designed to run on it...they generate more fissile material than they consume...and in theory they're eventually self-supporting...



It takes time for a breeder to produce enough plutonium to refuel another breeder...*not just years but decades!*

This 'doubling time' is put at 40 to 60 years for the French experimental plant in Marcoule — one of only a few operating breeders in the world today — but they're hoping for 30 to 40 years at the Super-Phénix in Malville...



TO HAIL THE BREEDER AS THE SOLUTION TO THE COMING URANIUM CRISIS IS TO IGNORE THE DOUBLING TIME FACTOR...

HEY! WE'RE NOT GOING TO PRODUCE FUEL FOR FURTHER REACTORS UNTIL WELL INTO THE NEXT CENTURY!

UNTIL THEN WE NEED BIGGER AND BIGGER BURNER PROGRAMMES.

YEAH!

HAIL

ALL HAIL, MIGHTY BREEDER!

HAIL HAIL

WE OF THE NUCLEAR ESTABLISHMENT KEEP VERY QUIET ABOUT THIS LITTLE PROBLEM...OR WE USE MISLEADING PROPAGANDA

SSH

SSH

THIS IS THE COVER OF AN AEC PAMPHLET...

ABOUT BREEDERS

Johnny had 3 truckloads of PLUTONIUM.

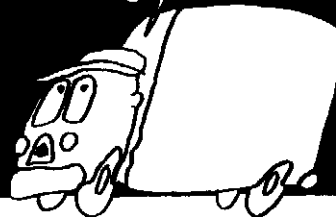
He used 3 of them to light New York for 1 year.

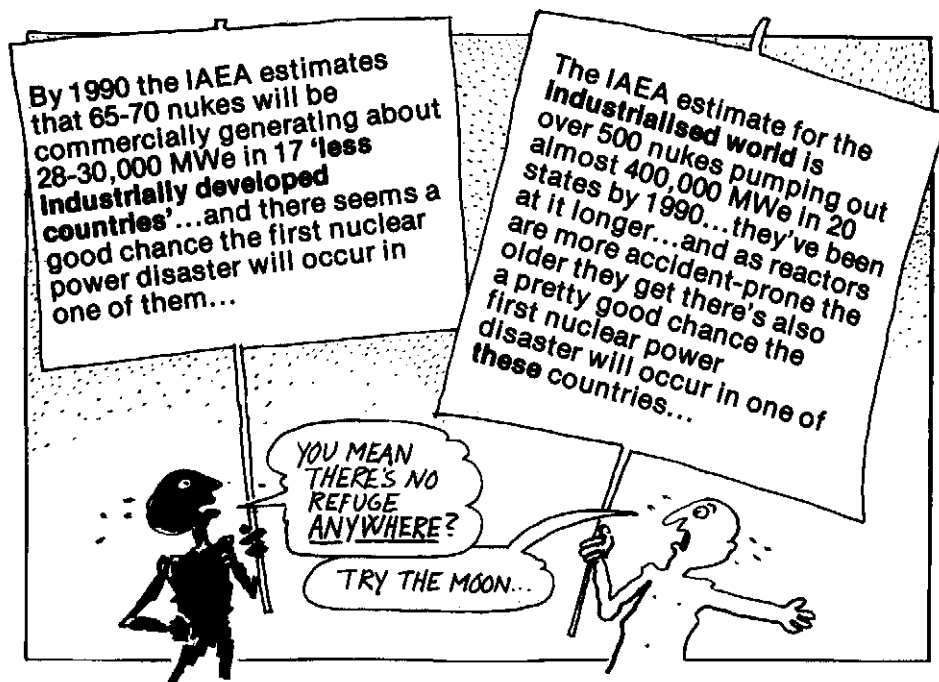
How much PLUTONIUM did Johnny have left?

Answer: 4 truckloads.

BY THE WAY, A TRUCKLOAD OF PLUTONIUM, COMPLETELY DETONATED, WOULD BLOW UP HALF THE UNITED STATES!

Given a 30-year doubling time Johnny would need ten years to get an extra truckload out of his breeder...not one year...assuming the thing worked at all...





COUNTRIES WITH COMMERCIAL NUKES OPERATING, UNDER CONSTRUCTION OR PLANNED

1975 - Argentina
Belgium
Britain
Bulgaria
Canada
Czechoslovakia
France
East Germany
West Germany
India
Italy
Japan
Netherlands
Pakistan
Soviet Union
Spain
Sweden
Switzerland
United States

1980 - Austria
Brazil
Finland
Hungary
South Korea
Mexico
Taiwan
Yugoslavia

1985 - Iran
Philippines
Poland
Rumania
South Africa

1990 - Cuba
Egypt
Israel
Thailand
Turkey

For the plutonium collectors among you:

A LUMP, HALF THE SIZE
OF A TENNIS BALL, CAN
WRECK A SMALL CITY.



If nuclear power grows
as fast as planned
commercial reactors
will be churning out
enough plutonium
each year by 1990 to
make 45,000 atom
bombs...

BY THAT TIME I'LL JUST
BE GETTING INTO
MY STRIDE.

A FULL-SIZED BREEDER
COSTS SOME £1,000 MILLION,
WHICH MEANS YOU CAN'T
EASILY REVERSE A DECISION
TO BUILD ONE ONCE
YOU'VE STARTED.



BIG BREEDER
PROGRAMMES WILL
MEAN A NEW AGE IN
WHICH ONE OF THE
WORLD'S MOST
VITAL RAW
MATERIALS IS
HIGHLY POISONOUS!



ON TOP OF EVERYTHING,
THEY LOOK PRETTY
UNSAFE!



Breeders are 'cooled' by liquid
metal...usually sodium...
which reacts explosively with
water or air. So a leaking pipe
can be a bit of a problem...



DA, THAT'S HOW MY
BREEDER AT
SHEVENKO BLEW
IT IN 1974.



OOPS...
FORGET EVERYTHING
I SAID...

Two who quit...

Safety and engineering standards are said to be higher in nuclear power technology than in any other comparable field.



Among the many experts who have deserted the nuclear camp are three highly-experienced engineers from General Electric in the US. One of them explained:

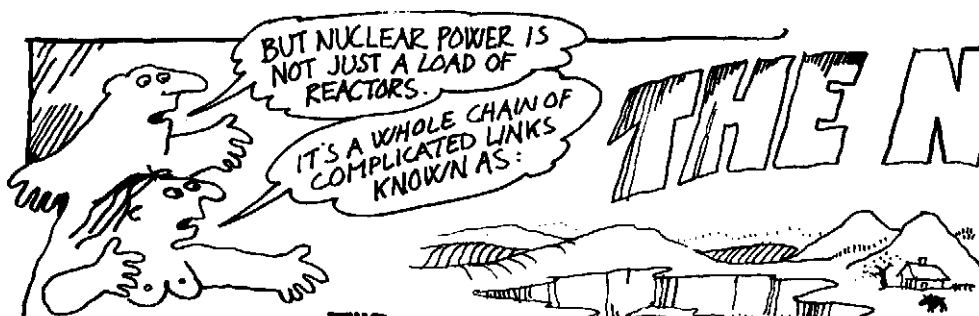
Dear Sirs:

In the past we have been able to learn from our technological mistakes. With nuclear power we cannot afford that luxury... Nuclear power has become a technological monster, and it is not clear who, if anyone, is in charge.

STAND BY FOR CHAPTER 5.

In which a cycle is not a cycle, radioactive waste is not disposed of, the spread of nuclear technology is not stopped and societies can not protect themselves from nuclear sabotage except by converting to a police state...





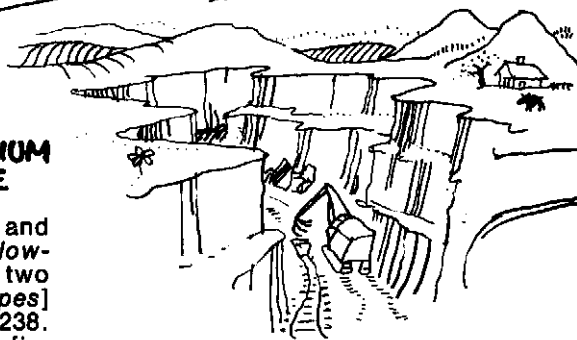
BUT NUCLEAR POWER IS NOT JUST A LOAD OF REACTORS.

IT'S A WHOLE CHAIN OF COMPLICATED LINKS KNOWN AS:

THE N

THE URANIUM MINE

Uranium ore is mined and concentrated into yellow-cake — a mixture of two uranium types [isotopes] called U-235 & U-238. Only U-235 can be fissioned to give energy but it makes up less than 1% of the uranium...

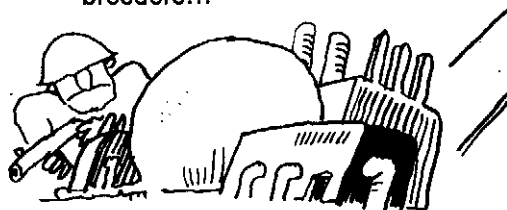


THE BREEDER REACTOR

Besides running on plutonium it converts U-238 into more plutonium... which can be used after reprocessing to fuel more breeders...

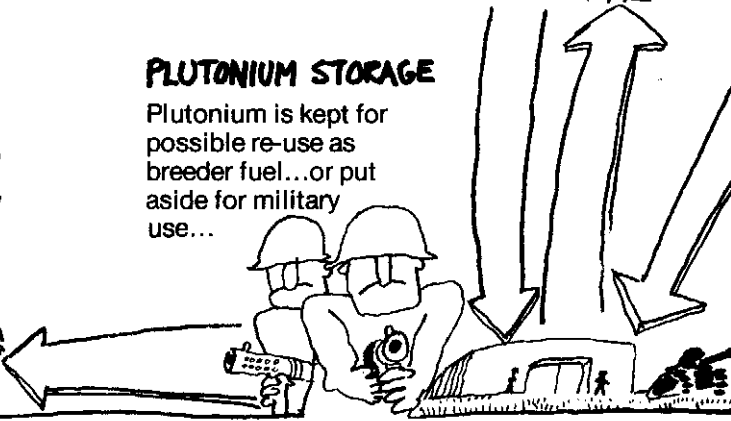
NUCLEAR ARMS PRODUCTION

About 10 kilos of plutonium is enough to make a crude nuclear device...

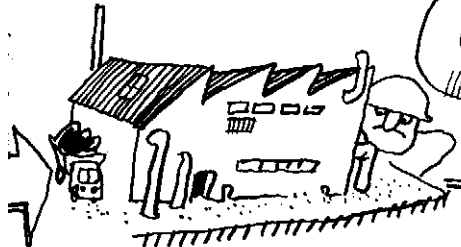


PLUTONIUM STORAGE

Plutonium is kept for possible re-use as breeder fuel...or put aside for military use...



NUCLEAR FUEL CYCLE



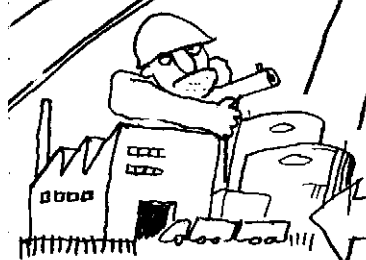
THE ENRICHMENT PLANT

By various techniques the U-235 content of the uranium is raised to 2-4%...



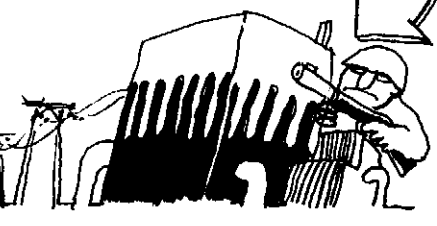
FUEL CONVERSION PLANT

The enriched uranium is converted into oxide pellets which are packed into fuel rods ready for the reactor...



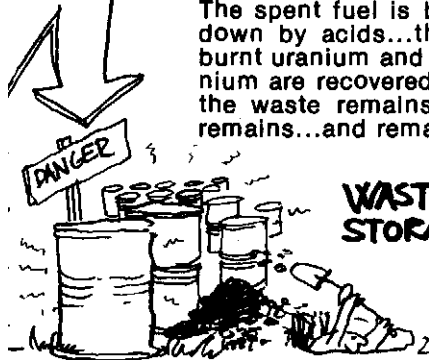
THE REPROCESSING PLANT

The spent fuel is broken down by acids...the unburnt uranium and plutonium are recovered...and the waste remains...and remains...



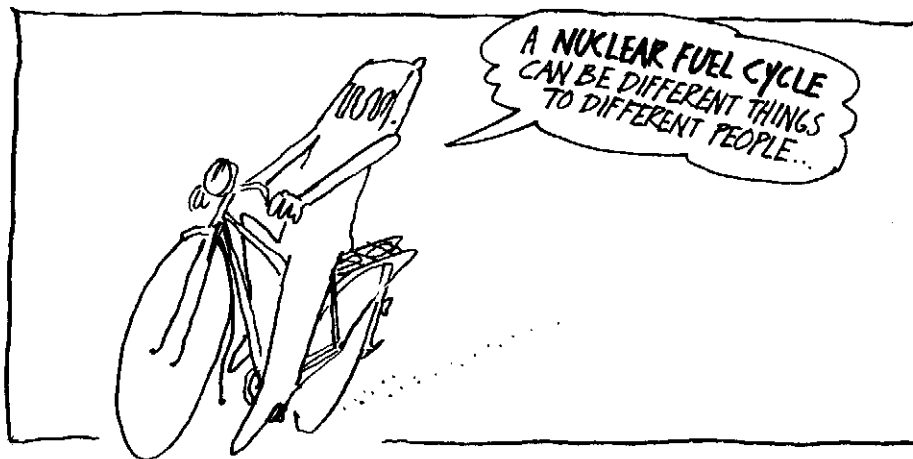
THE NUCLEAR REACTOR

The fuel fissions in the reactor core to generate heat for electricity production...and plutonium and radioactive 'fission product' waste...



WASTE STORAGE

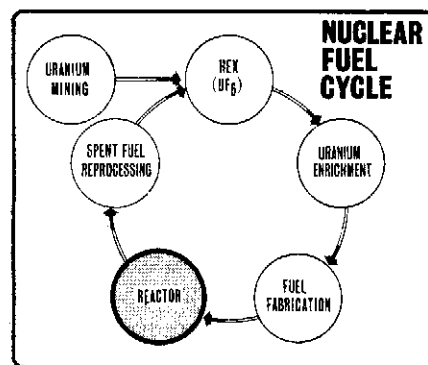
Highly radioactive [high-level] waste is so toxic that it must be isolated from all life for centuries or millenia! Today it's stored while experts try and figure out how to get rid of it...



AND THIS IS WHAT THE LONDON FINANCIAL TIMES WOULD HAVE US BELIEVE...

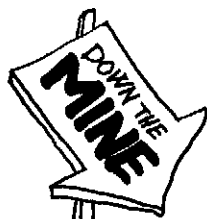
NO UNPLEASANT LEFT-OVERS LIKE RADIOACTIVE WASTE OR HOARDS OF PLUTONIUM...

IT JUST GOES ROUND AND ROUND AND ROUND...



In reality it's more like a game of snakes and ladders played out in a minefield. All along the way there are hazards to public health...but it's the worker in the nuclear industry who's the most directly threatened... especially in the mines, in reactor repairs and waste 'management'...





URANIUM MORE

Radioactive radon gas gets into the lungs...so not too many uranium miners collect pensions. According to the US Public Health Service, out of a total of 6,000 underground uranium workers, between 600 and 1,100 will die of lung cancer through radiation exposure...

THERE'S A SIMPLE REMEDY AND THE INDUSTRY HAS LONG BEEN AWARE OF IT — VIGOROUS VENTILATION.

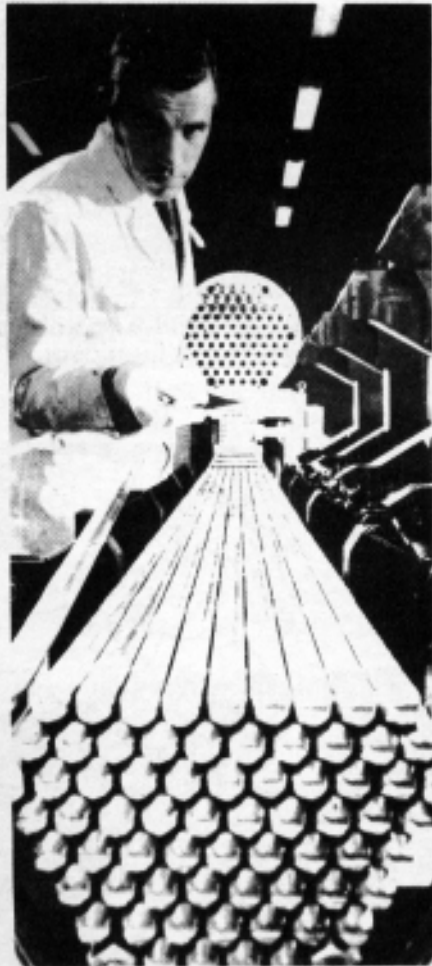
AH, BUT THAT'S A COSTLY BUSINESS. OUR SHAREHOLDERS WOULDN'T HAVE LIKED IT.

The big uranium producers are the US, Canada, France, South Africa, Australia and the Soviet Union. Mine conditions are alarming enough in Europe and North America... they're even worse in the French colonies of Gabon and Niger, in South Africa and Namibia, where the owners are under little or no pressure to ensure workers' safety...

BUT WE HAVE STATISTICS HERE SHOWING THAT THE BLACK MALE IS NOT SUSCEPTIBLE TO LUNG CANCER...

WONDER IF THE WHITE MALE IS SUSCEPTIBLE TO A DRILL UP HIS ARSE...

The left-overs after uranium is extracted from ore are called *tailings* and they're radioactive...which came as a bit of a shock to people in the US southern states who had found them lying about in sand-like heaps and decided they'd make fine foundation and building material...

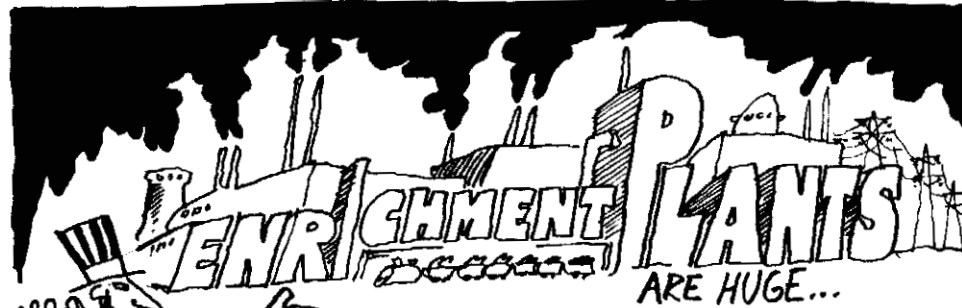


BEFORE...



...AFTER?

SAFETY AT ENRICHMENT AND FUEL FABRICATION PLANTS IS NOT A BIG PROBLEM because the uranium fuel is still in a fairly tame state...but the large-scale use of plutonium as fuel would change the picture completely...



YOU MAY NOT BE
SURPRISED TO HEAR
THAT I'M THE MARKET
LEADER.

They cover hundreds of acres
...they're tremendously
expensive...and they consume
as much electricity as a city of
half a million people...

The *Russians* and *Chinese* have their
own, in *Siberia* and *Lanchow*. The
European Common Market countries
have ganged up to build commercial
plants in *Britain* (Capenhurst),
France (Tricastin) and the *Netherlands* (Almelo)...

ALSO, OF COURSE,
URANIUM ENRICHMENT CAN
PROVIDE THE RAW
MATERIAL FOR
A-BOMBS...AS THE PEOPLE
OF HIROSHIMA LEARNED IN
1945...SO DESPITE THE COST
ENRICHMENT FACILITIES
ARE QUITE A POPULAR ITEM
IN THE NUCLEAR
CATALOGUE...

ENRICH THE RICH,
BOMB THE POOR...



IRAN



THE WEST GERMANS ARE
MAKING ONE SPECIALLY FOR ME.

AND THEY'VE
SOLD ME A SLICE
OF THE ACTION.

SLURP
SLURP

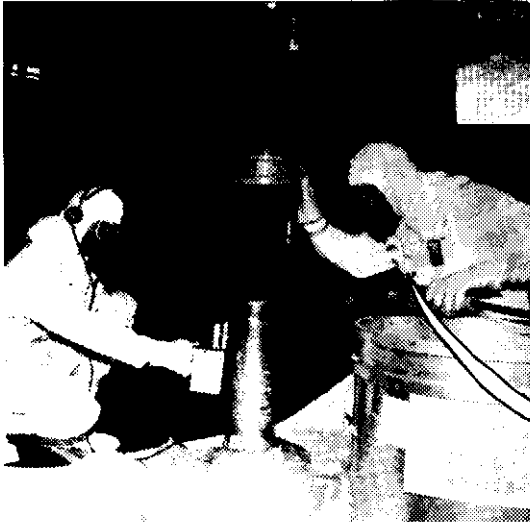
BRAZIL



Also in the race are *Canada* (James Bay), *Japan* (Tokai Mura) and *South Africa* (Valindaba). A test plant began operating at Valindaba in 1975...which may explain why South Africa was in a position to conduct a nuclear bomb test in 1977...

AS FOR THE REACTOR...

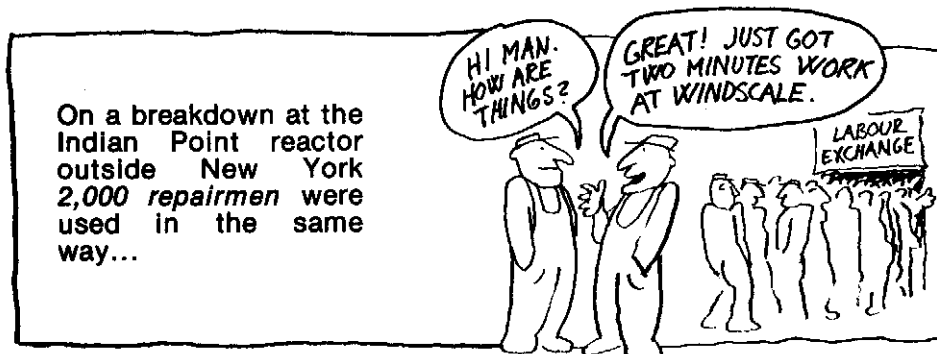
The nuclear industry is always issuing publicity photos like this to show us how nice and safe it is to work in a nuke...



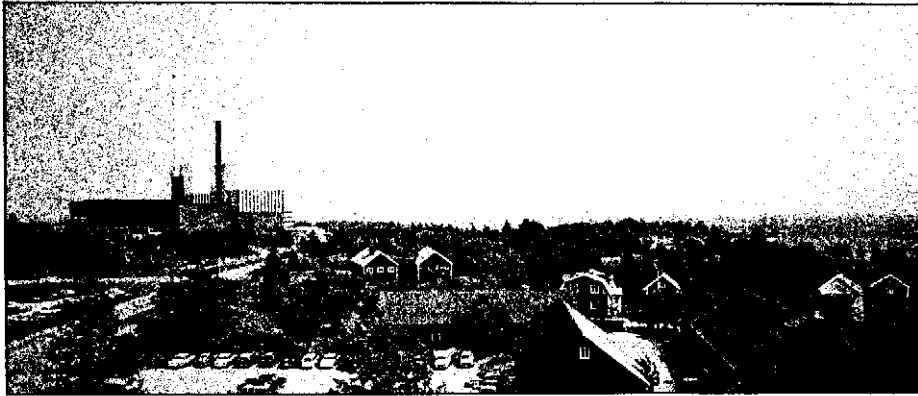
For some reason photos of repairmen in action in a real emergency don't find their way into the PR brochures... and very rarely into the newspapers...

MAYBE PHOTOGRAPHERS AREN'T TOO KEEN ON RISKING THEIR LIVES...

The Swiss nuclear power industry once ran out of top-flight welders! All 700 who were qualified for the job collected the maximum radiation dose when repairing a reactor at Beznau...radiation was so intense that each welder could work for only two minutes...



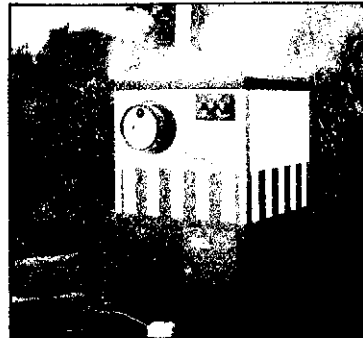
IT DEPENDS HOW YOU LOOK AT IT...



Top: THE OFFICIAL PICTURE...
BLUE SKIES & UNSPOILED NATURE...
AND IT'S SO HARMLESS YOU CAN
LIVE RIGHT NEXT DOOR...

Middle: THE REACTOR AS IT MIGHT
BE SEEN BY THE OPPONENT OF
NUCLEAR POWER WHO JOINS A
DEMONSTRATION...

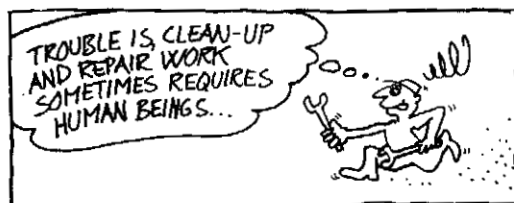
Right: THE HOUSEHOLD REACTOR
(MID-21st CENTURY) AFTER BEING
TAKEN OUTSIDE BY THE REPAIRMAN...



OVER AT THE RE-PROCESSING PLANT

There's a lot of plutonium and radioactive fission products being handled ...so almost everything has to be operated by remote control from behind thick shielding...

The French plant at La Hague was the only one by 1978 capable of treating LWR oxide fuel...a lot of countries were queuing up...and as the order-book swelled the management exposed the workers to increasing doses of radiation. In the face of union protests more and more unorganised, short-time labour was employed...often with only a couple of days' training!



La Hague workers told union investigators...

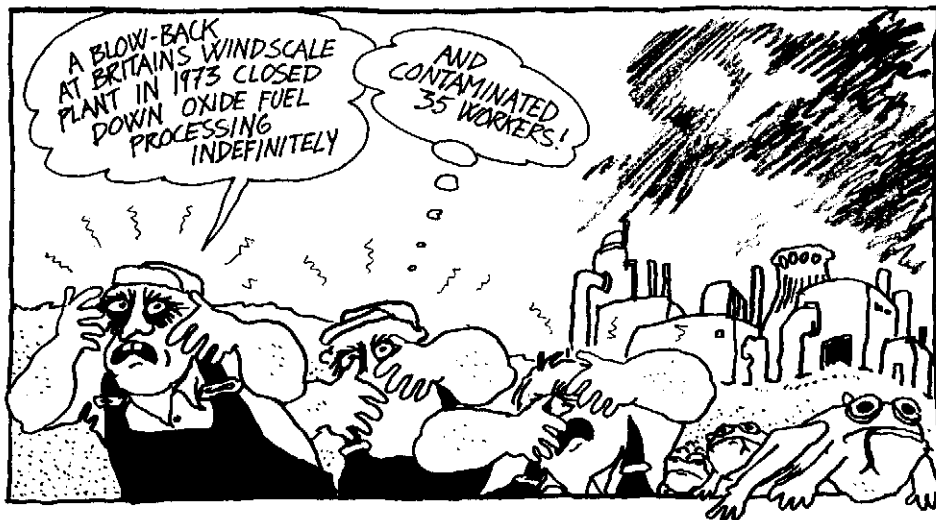


The workers at La Hague had to strike for months before the French nuclear industry would do anything about their working conditions...



A reprocessing accident can be at least as dangerous to the public as a reactor accident...yet the reprocessing plant lacks most of the reactor's safety barriers...

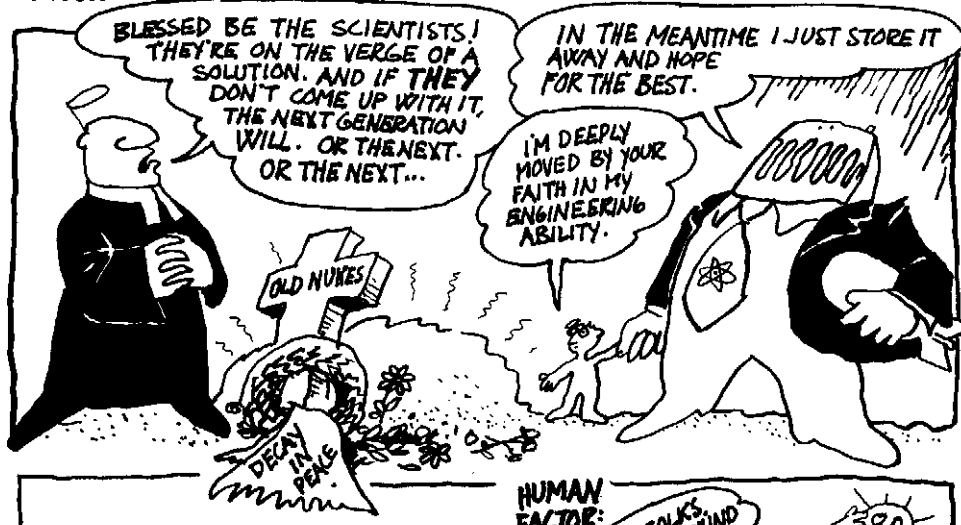
Radioactivity could escape into the environment if the witches' brew leaked out of the acid pond...or the coolant failed and the waste boiled...or the ventilation packed up and there was a chemical explosion...



REPROCESSING IS SUCH A DIFFICULT AND RISKY BUSINESS THAT IT HAS MORE OR LESS BEEN ABANDONED IN THE U.S....WITH GIANT LOSSES. GETTY OIL, GENERAL ELECTRIC, GULF AND SHELL HAVE ALL BURNED THEIR FINGERS...

Some people haven't given up, though. New plant for reprocessing oxide fuels is planned or being built in Britain (Windscale), West Germany (Karlsruhe), India (Tarapur) and Japan (Tokai Mura)...and La Hague aims to expand...

Finding a final resting place for high-level nuclear waste is a problem that has baffled scientists ever since the stuff started piling up in the 1940s...



Interim storage is a neat way of passing the buck...but liquid radioactive waste is a sizzling peril. In the United States more than 400,000 gallons have seeped away from one storage facility at Hanford on the Columbia River...



There was also a big leak from Windscale's storage tanks in 1976...

The Windscale management reacted in the true spirit of the nuclear establishment, which has always had the welfare of the general public at heart...

How nuclear cover-up went wrong

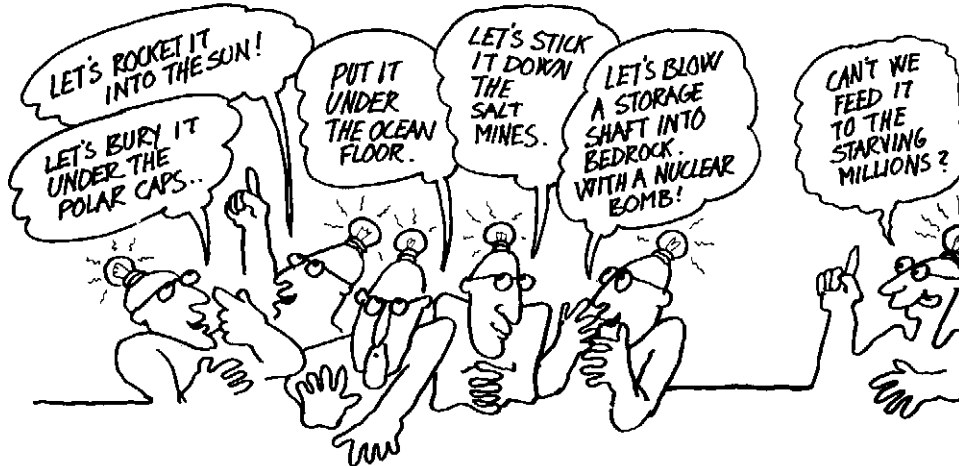
TOP officials at British Nuclear Fuels Ltd decided from the start to cover up the facts about a radioactive leak from their Windscale plant because they feared repercussions at a critical moment in the site's development.

Even when they were urged by officials from the Government's Health and Safety Executive to make the facts public they still said nothing, although by staying silent they contravened the spirit of the Nuclear Installations Act.

ALL PROPOSALS FOR LONG-TERM STORAGE OR DISPOSAL OF HIGH-LEVEL WASTE FROM THE NUCLEAR POWER INDUSTRY LIE AT THE RESEARCH AND DEVELOPMENT STATE...WHILE STOCKPILES GROW FASTER AND FASTER AROUND THE GLOBE...

There have been lots of *theoretical* solutions...

But in the words of the Nobel Prize-winning physicist Hannes Alfvén: *'If a problem is too difficult to solve one can not claim that it's solved by pointing to all the efforts made to solve it...'*

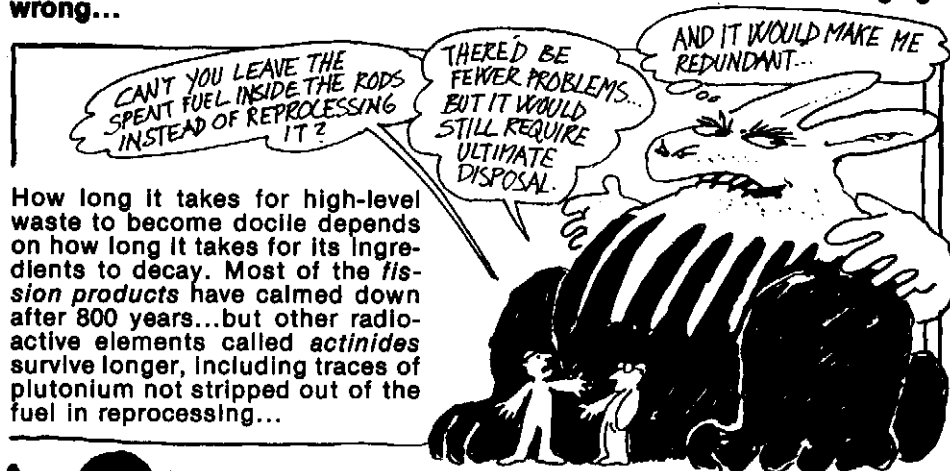


BECAUSE OF THE IMMENSE TIME IT TAKES FOR HIGH-LEVEL WASTE TO COOL DOWN AND BECOME HARMLESS NO METHOD CAN BE GUARANTEED COMPLETELY SAFE...

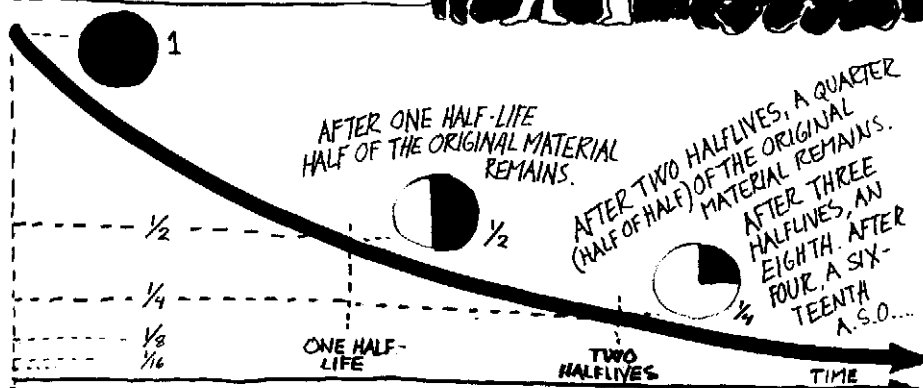
“We must assume that these wastes will remain dangerous and will need to be isolated from the biosphere for hundreds of thousands of years. In considering arrangements for dealing safely with such wastes man is faced with time scales that transcend his experience...”

— Flowers Report to British Parliament
September 1976

Exhaustive research has failed to turn up anything but a couple of reasonably promising ways of solidifying the waste...and the bright idea that it would be best stored where it's retrievable in case things go wrong...



How long it takes for high-level waste to become docile depends on how long it takes for its ingredients to decay. Most of the fission products have calmed down after 800 years...but other radioactive elements called actinides survive longer, including traces of plutonium not stripped out of the fuel in reprocessing...



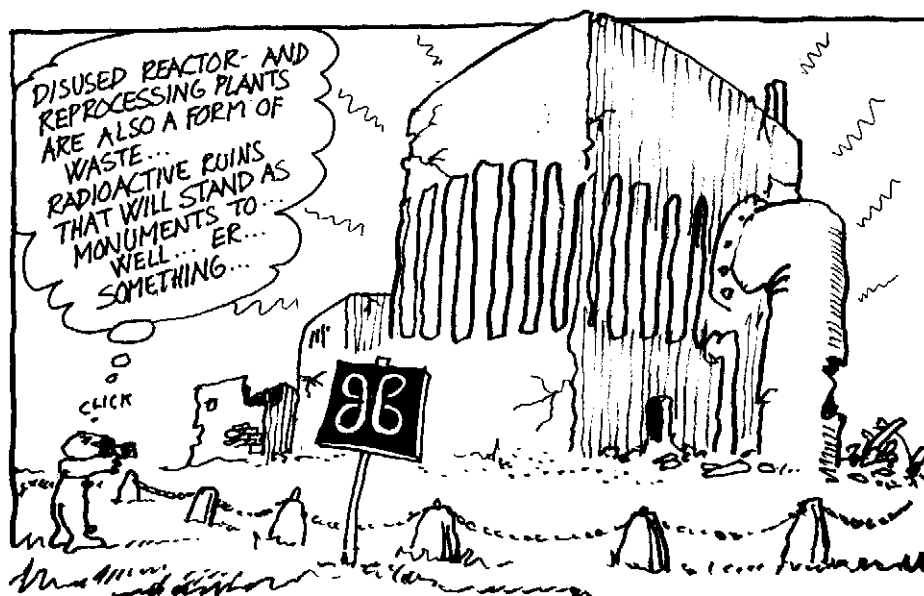
The rate-of-decay of a waste product is measured in its half-life — the time it takes for half the amount of material to disintegrate. For example Caesium-137 has a half-life of 30 years...so reducing radioactivity a thousand-fold takes 300 years (ten half-lives). Species like Strontium 90 (28 years), Curium-244 (18 years) and Caesium-137 are more dangerous than long-life ones like Plutonium-239 (24,400 years) because their radioactivity is more concentrated...

THE PROBLEM IS THAT HEAVY, RADIOACTIVE ELEMENTS LIKE PLUTONIUM DECAY INTO OTHER RADIOACTIVE ELEMENTS, WHICH DECAY INTO OTHERS AND SO ON...AND DON'T FORGET THAT, APART FROM THEIR RADIATION, THESE ELEMENTS ARE HIGHLY POISONOUS!

High-level waste is not the only problem...there are medium-activity and low-activity left-overs as well...in much larger quantities...

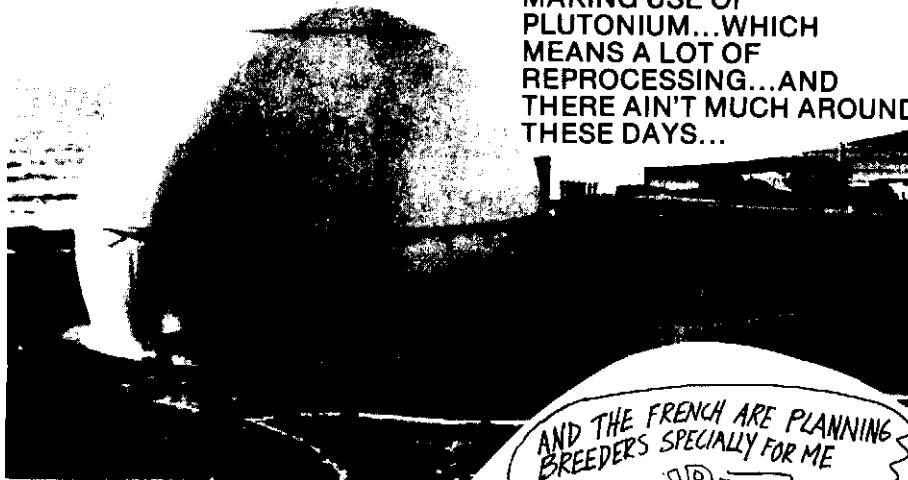
Low-level waste is routinely discharged into the surroundings, buried in the ground or dumped at sea...

Most medium-level waste is toxic enough to require isolation for centuries. It can include anything from protective clothing to old bits of reactor...



WHERE DOES THE BREEDER COME IN?

IT'S SUPPOSED TO CLOSE*
THE FUEL CYCLE...BY
MAKING USE OF
PLUTONIUM...WHICH
MEANS A LOT OF
REPROCESSING...AND
THERE AIN'T MUCH AROUND
THESE DAYS...



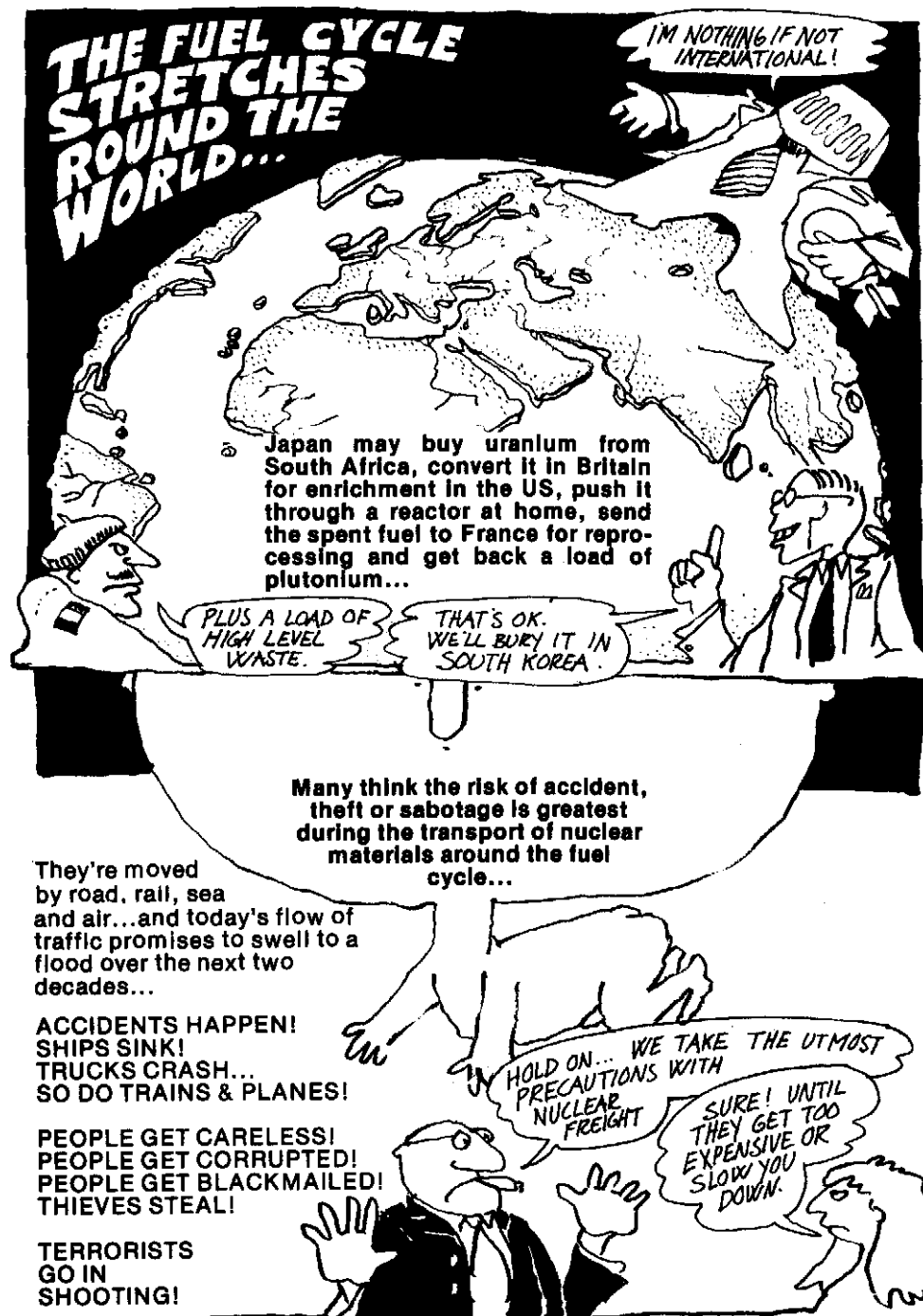
So it's not strange that the
people going for breeders are
also going for reprocessing...
the Soviet Union, Britain,
France, West Germany, Italy,
India and Japan...



President Carter set the cat among the pigeons in 1977 by halting
commercial reprocessing and plutonium recycling in the US. But his
appeal for others to follow suit was met with suspicion...



*
The only way to close the fuel cycle is to shut your eyes and
pretend there's no such thing as radioactive waste...



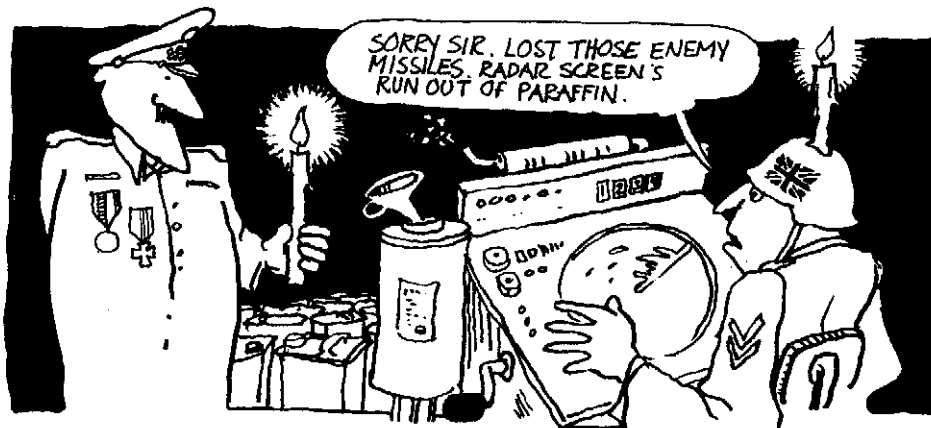
THE NUCLEAR PARK SOLUTION...



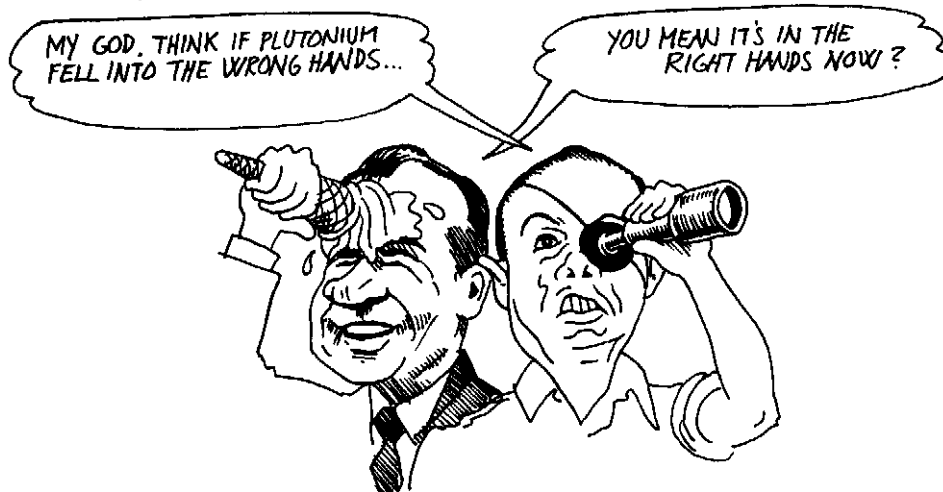
The industry claims that the latest reactors are built to withstand a crashing plane. But not a Jumbo-size airliner. Nor a big bomb. As for reprocessing plants, they're almost totally unprotected from things falling out of the sky...

IN THE EVENT OF WAR...NUCLEAR POWER IS A LIABILITY...

Nukes are such obvious and potentially disastrous targets that the only sensible thing to do if hostilities break out is to *close them down*...so countries with most of their energy eggs in the nuclear basket will be fighting the war in the dark...



A TRIP DOWN PARANOIA GULCH...



What people usually mean by the 'wrong hands' are those belonging to guerilla groups, organised crime syndicates, stray madmen or leaders of the Third World... as opposed to characters of infinitely sound judgement like Richard Nixon, Moshe Dayan, NATO and Warsaw Pact generals...

The name of the game is...
CLANDESTINE DIVERSION OF PLUTONIUM

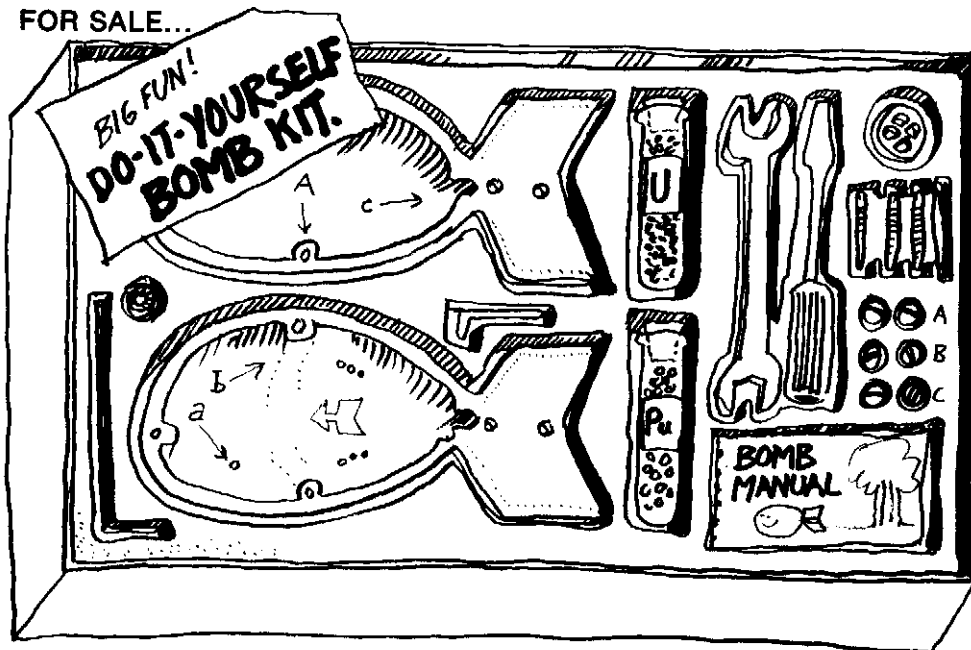
or...
**NUCLEAR PROLIFERATION AT GOVERNMENTAL
AND NON-GOVERNMENTAL LEVEL**
or quite simply...
SPREADING THE BOMBS AROUND

Two years after the Indian Bang showed *Atoms for Peace* and *Atoms for War* to be Siamese Twins the record was officially put straight by an NRC Commissioner:

'international action to control (the dangers of proliferation) associated with the civilian nuclear fuel cycle depends critically on the understanding of two facts. First, that nuclear weapons can be manufactured from

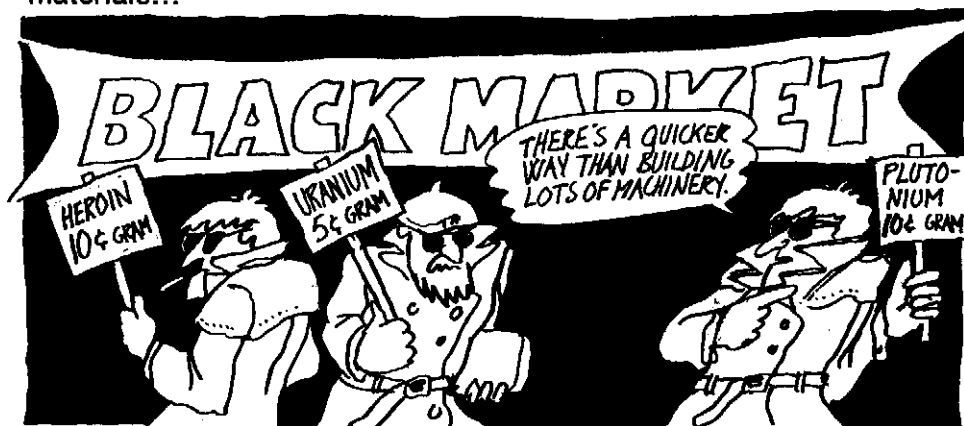
reactor-grade plutonium. And second, that for any nation that has done its homework, separated plutonium can be suddenly appropriated from its storage place and inserted in warheads within days.'

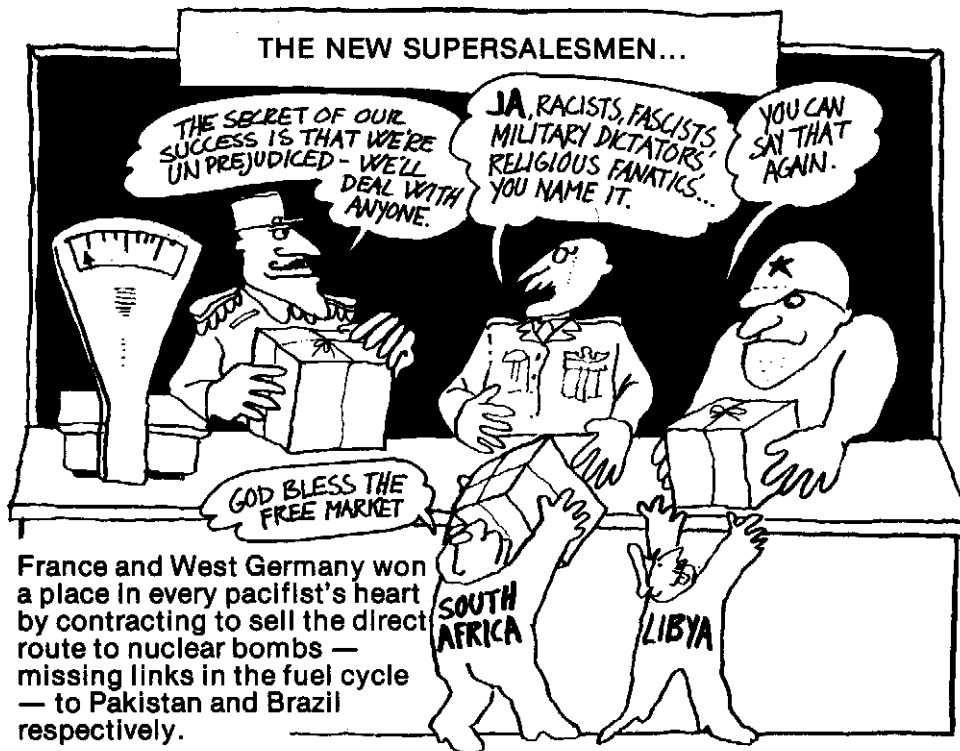
FOR SALE...



You don't need a big nuclear power programme to make nuclear weapons under the counter...as the Indians demonstrated. A small research reactor...laboratory-scale reprocessing...and the whole thing was said to cost only \$400,000...

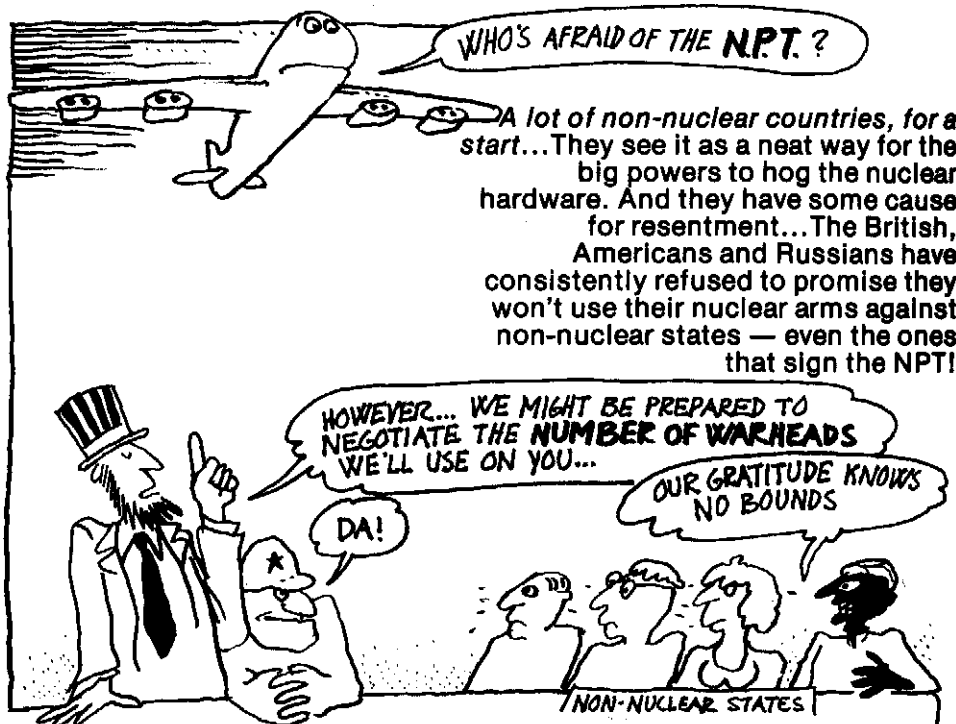
A humble little 40MWe reactor gives enough plutonium a year for three Hiroshima-size bombs. The Stockholm International Peace Research Institute (SIPRI) says the components can be discreetly bought on the open market for \$20 million...and small reprocessing and uranium enrichment units are also available to those anxious for bomb materials...





Today, in the shadow of the Soviet-American nuclear arms race, local rivals are engaged in contests of their own. The Pakistanis are scrambling to catch up with the Indians...the Brazilians are vying with Argentina for nuclear leadership of Latin America...and both Egypt and Israel are already believed to have access to nuclear weapons.





If you read the small print it's very clear why many countries choose not to sign the NPT... *the treaty obliges signatories to help non-signatories with nuclear energy programmes wherever possible!*

THAT'S HOW INDIA GOT HOLD OF THAT CANADIAN REACTOR...IT JUST WENT AND ORDERED IT!

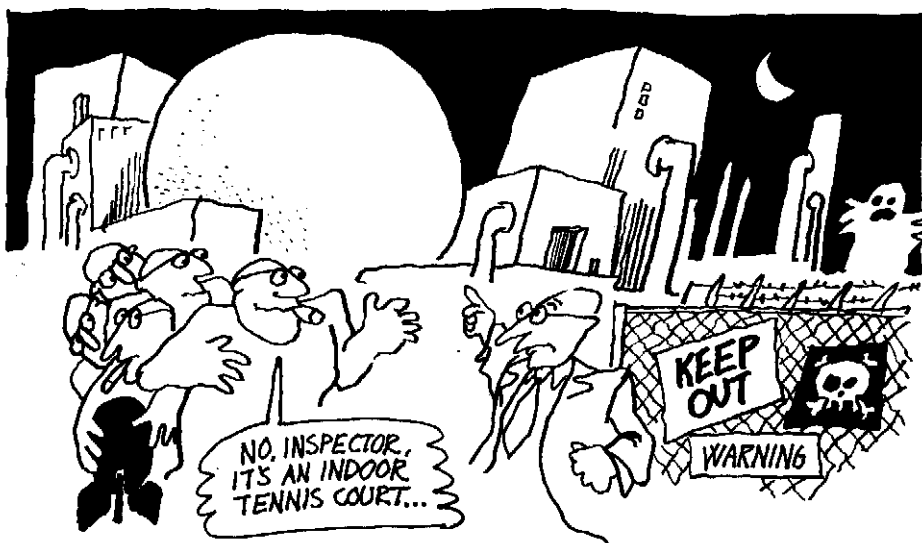


FROM ONE PAPER TIGER TO ANOTHER...



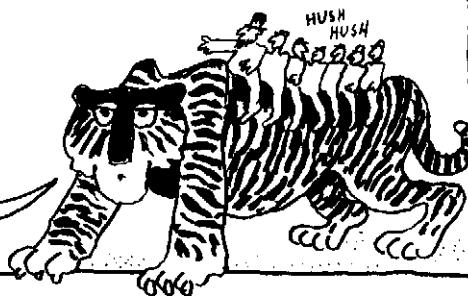
Even when it's signed the NPT is not much of a deterrent as membership can be cancelled at 3 months' notice...or simply ignored in a 'national emergency'...then you just clap a warhead onto the missile the NPT allows you to assemble and off you go...

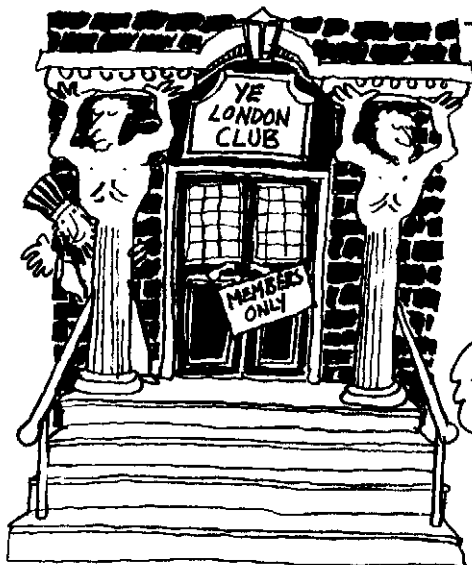
Many experts doubt that legal safeguards are enforceable anyway... Treaties invariably have loopholes...nuclear inventories are quite easy to fiddle...bomb tests can be simulated on computers...and an inspector's task can be made virtually impossible on site...



So the nuclear 'haves' decided to lean on the 'have-nots' a bit more heavily...they formed THE LONDON CLUB...

A HUSH-HUSH GATHERING OF 14 NUCLEAR EXPORTERS - IN OTHER WORDS, MOST OF THE INDUSTRIALIZED NATIONS.





The London Club claims it wants to stop the spread of sensitive technology and know-how to the 'wrong quarters'. At the same time, its members are competing with one another in a cut-throat multi-billion dollar export industry...

AND WE ALL KNOW THE UPSHOT OF CONFLICTS LIKE THIS

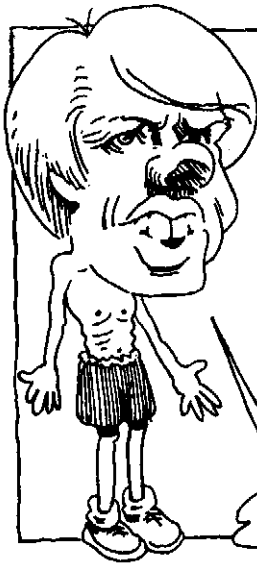
WHO'S WILLING TO LOSE MARKETS JUST FOR THE SAKE OF WORLD PEACE?

so it's no surprise that they can't agree which countries to sell their goodies to under what circumstances...or rather which countries not to sell their goodies to...

GUESS WHO'S MAKING MOST OBJECTIONS?

LONDON CLUB'S A BUNCH OF CISSIES

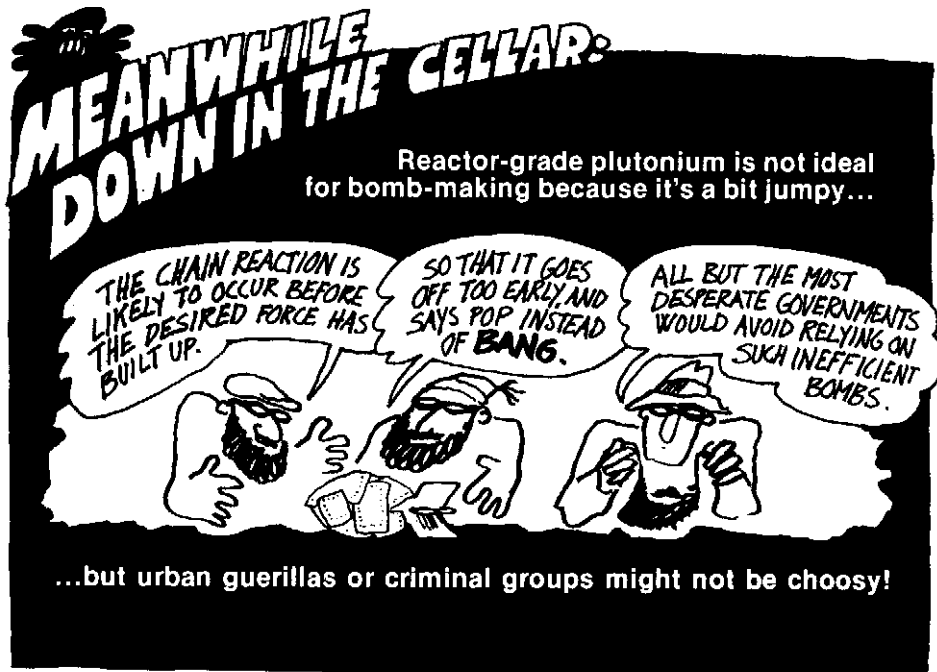
JA



Slightly more promising for the future of humanity was Carter's 1977 initiative to strangle reprocessing and breeders and his announcement that recipients of US nuclear exports would be required to place them under the IAEA safeguards...

Carter also got 40 nations to join in an International Fuel Cycle Evaluation (INFCE)...and although it implied a two-year pause in plutonium development around the world the French and West Germans were among them...

SEE THAT? I STILL CARRY SOME NUCLEAR MUSCLE.



Authorities like the NRC say reactor-grade plutonium can be used by such outsiders *on the basis only of existing information in the open literature* to make crude but convincing bombs...of unpredictable yield but enough to wipe out a seat of government...

SIPRI SUMMED UP THE HAZARDS LIKE THIS...

“Plutonium could be stolen and sold on a «black market», or it could be ransomed, or a group of criminals might steal plutonium for profit, or for use as a nuclear threat to deter police or otherwise further their activities. Or one of the more than 50 terrorist groups that are said to exist worldwide might see nuclear weapons as means of enhancing its capability to use, or threaten, violence. Or a revolutionary-minded political group within a country might acquire nuclear weapons to achieve its political objectives or to deter violence against it. And it should not be forgotten that the danger inherent in a crude nuclear device constructed by, for example, a terrorist group is not confined to a possible nuclear explosion. The contamination of a large area by high levels of plutonium would be an enormous threat in itself.”

A London newspaper which received a 'credible' A-bomb design from a group of students asked some scientific and weapons experts to describe in concrete terms the amateur nuclear weapon threat...

THE TERRORIST A-bomb is about the size of a tea-chest, weighs around half a ton, could be conveniently carried in an inconspicuous vehicle such as a Transit van, and would be detonated remotely by radio.

If the yield of one kiloton was achieved its fireball would be about 70 metres in diameter, vapourising much of the area where it touched the ground. All exposed people within a radius of half a kilometre would be killed directly by thermal and other radiation, while devastation of structures by blast might extend over a radius of about 1 kilometre. In some meteorological conditions, such as a surface temperature inversion which is common in Britain at dusk and during the night, blast damage might extend over a radius of up to 3 kilometres.

Because this would be a surface burst the radioactive plume would be large and would contain a great deal of particulate material which, re-condensed from the fireball, would contain highly radioactive fission products and core residues. As in other nuclear incidents the behaviour of this cloud of dangerous material would depend upon meteorological conditions, but airborne radioactivity is impossible to control and would descend on random segments of the population before any

effective warning could be given. Among those affected and heavily exposed death might ensue within seven weeks. A much larger segment of the population might be affected in a way which, much later in life, produced cancer in some form.

If such a weapon were exploded in, say, the car park outside the House of Lords, the seat of Government would be destroyed and rendered ineffective for a long period. The cost of clean-up alone, on present industrial estimates of about £1 million per gramme of plutonium, would be well over £1 billion. The cost of damage repair is inevitable but would probably be of the same order.

* Premature detonation means the thing might go off a millionth of a second too early — not while it's being built or transported...

* Safe handling of strategic materials and high explosives is widely known and described in many textbooks...

* Chemical conversion of the materials is not much riskier than heroin synthesis...and that's been going on in criminal laboratories for a long time...

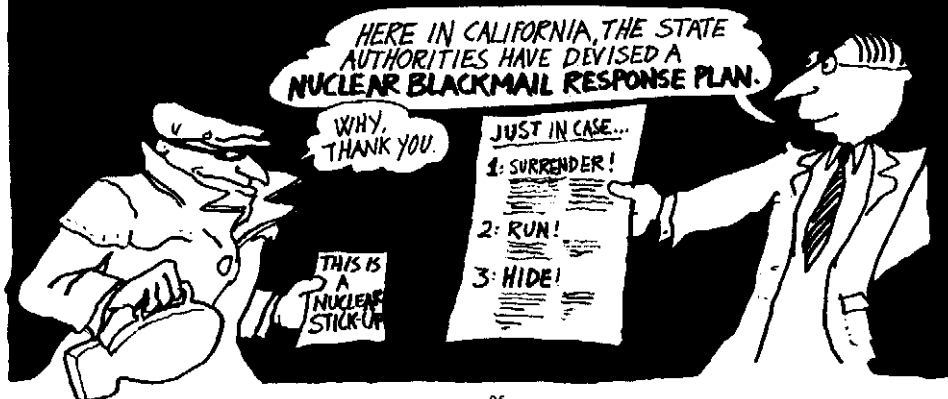


GETTING HOLD OF THE PLUTONIUM MAY BE ONE OF THE EASIER PARTS OF THE OPERATION...THE HISTORY OF PLUTONIUM MANAGEMENT IS FULL OF UNEXPLAINED LOSSES, CARELESSNESS AND 'COOKED BOOKS'...

Accounting systems for nuclear materials can never be more than 98-99% accurate...and 1% of the annual throughput at a reprocessing plant, for example, is enough for a cartload of bombs...



Thousands of people are handling plutonium every day in the nuclear industry. There's 'statistical uncertainty' about 4 or 5 tons of potential nuclear weapons material in the US alone — say about 1,000 bombs. Perhaps none of it has been taken...or all of it! As no-one knows for sure, all threats that sound technically feasible have to be taken seriously...

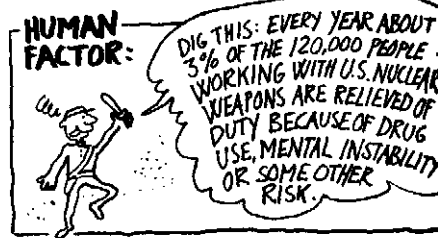


WELCOME TO THE POLICE STATE...



In the security business it's generally agreed that you can't protect anything from people determined enough to get it...if that were possible there'd be no plane hijacks or bank robberies...And here again we have to take into account the human factor...

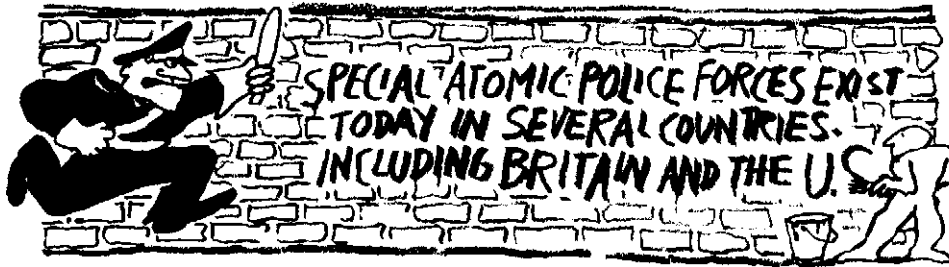
IF THE NUCLEAR POWER INDUSTRY'S INSISTENCE THAT IT CAN SAFELY GUARD THE FUEL CYCLE IS TO BE TAKEN SERIOUSLY SOME DRASTIC STEPS WILL BE NEEDED VERY SOON...



All dissent in a Fissile Society can be viewed as a threat...so the least we can expect is an escalation of police & military surveillance...in fact what measures could not be justified in the name of NUCLEAR SECURITY?



THE WRITING'S ALREADY ON THE WALL...



Britain, we're told, is a stronghold of democratic tradition...The Atomic Energy Authority [Special Constables] Act of 1976, which legalised an armed nuclear police force, showed that plutonium security and democratic controls don't mix...

This little army of atomic cops is *not directly accountable to a government minister*, only to the AEA. One study has suggested that this is because it's recognised in the corridors of power that some nasty breaches of civil liberties might be needed in a plutonium emergency. In which case the government might find it convenient to plead ignorance...



In the US at least one private nuclear police force (VEPCO's) is seeking the same powers of pursuit, arrest and access to confidential files as the regular state police. And there's talk on Capitol Hill of creating a special federal force that can skip bothersome details like court orders and formal charges, and even under certain circumstances torture suspected 'nuclear terrorists'...

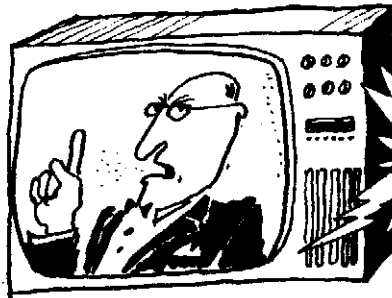


In many parts of the world — especially Western Europe and North America — the general public is growing more and more disturbed about nuclear power. The authorities can no longer proceed unchallenged.

The public is demanding inquiries, fighting building applications and staging giant rallies and demonstrations in numerous countries...

A situation has arisen in which public participation in energy question is seriously disrupting governments' plans for nuclear expansion...

Pushing on down the nuclear path in the face of public opposition is as good a way as any of sparking civil disobedience. Direct action has already begun in many countries. For example there've been...



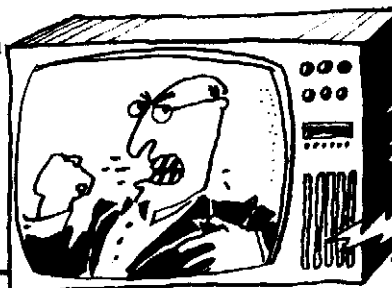
SO I'M AFRAID WE HAVE TO CHANGE THE GROUND RULES. AS FROM NOW PUBLIC INVOLVEMENT IN OUR AFFAIRS IS ILLEGAL!

OCCUPATIONS of proposed nuclear sites in the US, France, Britain and West Germany...

BOMB ATTACKS on nuclear installations in France, Spain, Switzerland and the US...

LEAKS of stolen confidential nuclear information in Australia...

If governments remain unswayed direct action against fuel transports and existing fuel cycle facilities also seems likely as well as interference with national electricity supplies...



AS YOU STILL WON'T ACCEPT THAT WE KNOW BEST, WE'RE CONVERTING TO A POLICE STATE

A TECHNOLOGY THAT SOCIETY MUST ADAPT TO...

A plutonium economy demands centralised, authoritarian rule...with fewer people wielding more power...and erosion of civil rights...starting with the right to organise labour...

Add the political and social risks to the proliferation and safety hazards of nuclear power and the picture begins to emerge of a highly oppressive technology...

HERE IN AUSTRALIA THEY HAVE ALREADY OUTLAWED INDUSTRIAL ACTION IN THE NUCLEAR INDUSTRY.

WORKERS UNITE

KANGA-ROONI-ON

WHO NEEDS NUKES?

The public?

NO THANKS...

The Scientists?

NO, THEIR TALENTS CAN BE BETTER EMPLOYED ELSEWHERE...

The Military?

YES! IT JUSTIFIES THEIR EXISTENCE!

The Engineers?

NO, FOR THE SAME REASON...

State Governments?

SOME OF THEM HAVE STAKED THEIR FUTURE ON IT. (AND OURS...)

Monopoly Capitalists?

IS IT PROFITABLE?

ONLY AS LONG AS IT IS PROFITABLE... OR IT UNDERPINS THEIR PROFITS IN OTHER SECTORS... OR PRESERVES THE POLITICAL STATUS QUO SO THAT THEY'RE FREE TO ACT...

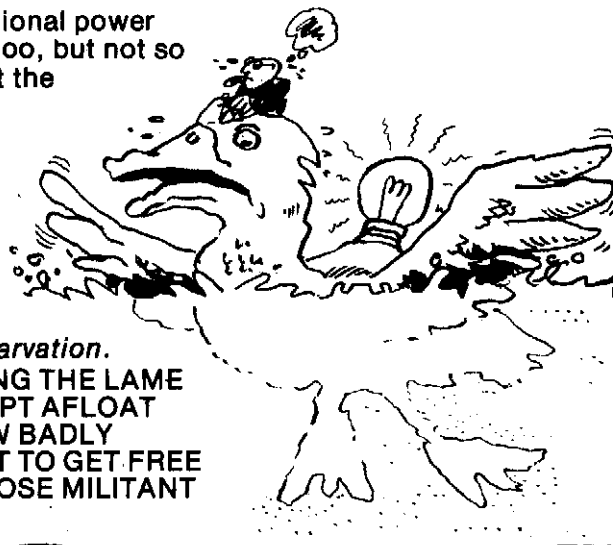
If governments weren't propping up the nuclear industry it would soon go under. Quick profits can still be made here and there...but on the whole it's a bad investment in straight capitalist terms.

PUBLIC RESISTANCE is one of the main reasons that nuclear electricity, once hailed as a bargain, now looks a dubious economic bet. In the US, delays and safety modifications forced through by environment groups helped send *capital costs* rocketing during the 1970s...



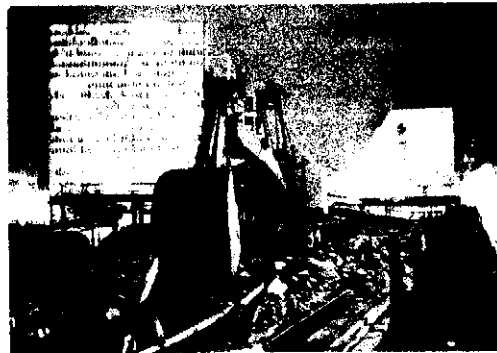
Capital costs of conventional power stations are increasing too, but not so fast. US analysts expect the price of nuclear electricity to catch up with the price of coal-based electricity around the mid-1980s. One of them, Barry Commoner, thinks nukes will soak up so much money that they'll lead to *capital starvation*.

IN THE END, HOW LONG THE LAME NUCLEAR DUCK IS KEPT AFLOAT MAY DEPEND ON HOW BADLY GOVERNMENTS WANT TO GET FREE OF OPEC AND ALL THOSE MILITANT COAL-MINERS....



TUNE IN TO CHAPTER 6.

In which we're invited to choose between hard & soft, the Energy Junkie tries to justify his habit, Illich and Lovins have a say and some Third World countries take matters into their own hands...



SAYING 'NO' TO NUKES MEANS SAYING 'YES' TO SOMETHING ELSE!

Little would be won if it meant saying 'yes' to ferocious consumption of coal, oil & gas...their risks are well-known...

* As a workplace the coal mine is as hazardous as the uranium mine...

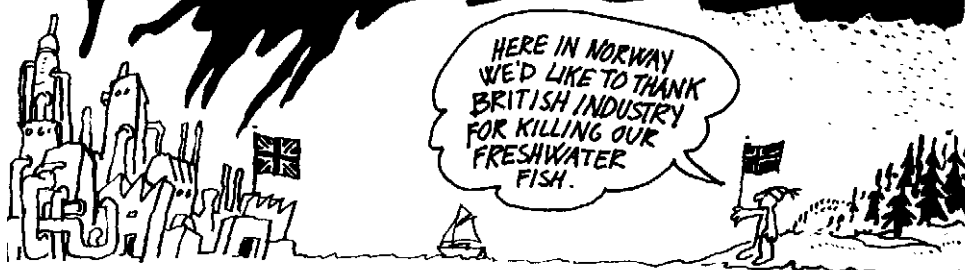
* The death rate for oil industry divers in the North Sea is notoriously high...

* Tankers carrying frozen natural gas can explode like a small A-bomb...at sea or in harbour...



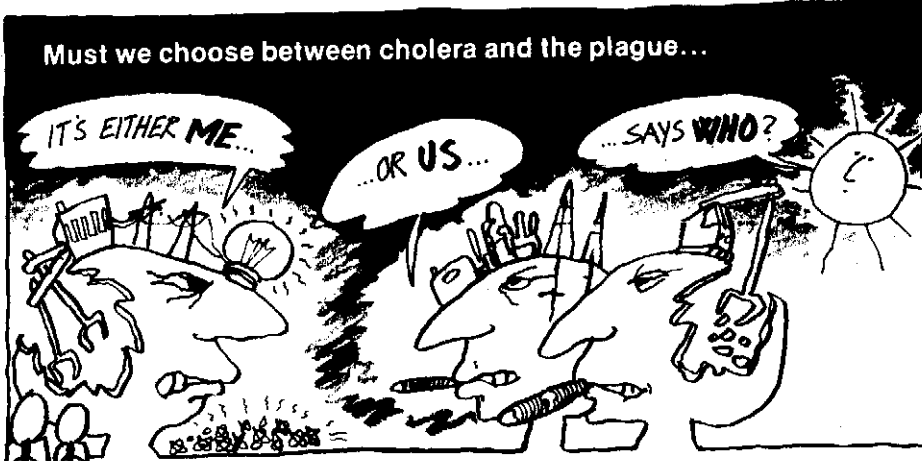
Then there's the threat to the natural environment...

Oil tankers keep colliding, sinking and running aground, often with disastrous consequences... and oil rigs blow out or leak... and «acid rain» from the burning of oil and coal pollutes lakes and soil...sometimes very far afield...



Also, burning coal, gas & oil raises the carbon dioxide content in the Earth's atmosphere...heating it up...so continued use of fossil fuels at today's rapid rate can upset the world climate...

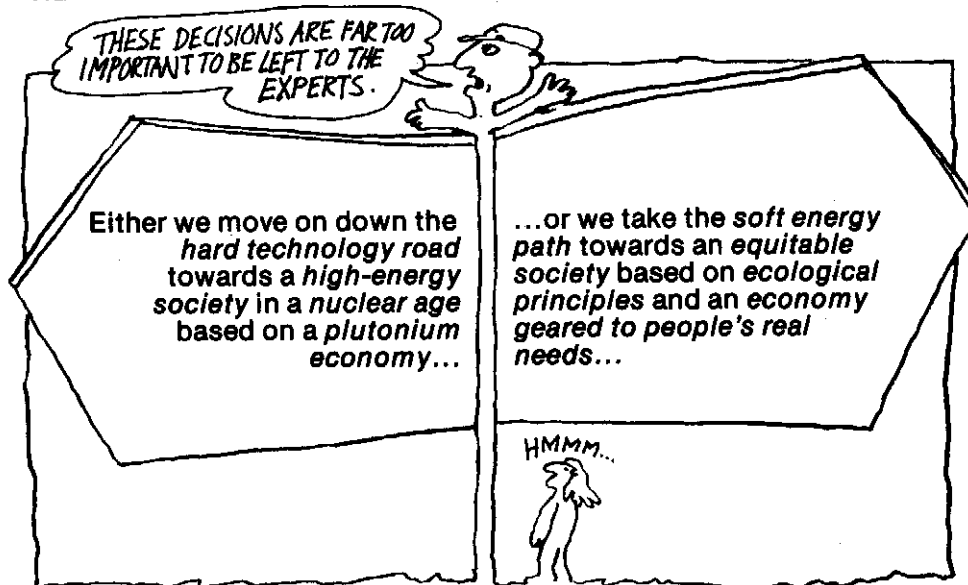
BUT COMPARING THE RISKS IS MISSING THE POINT.



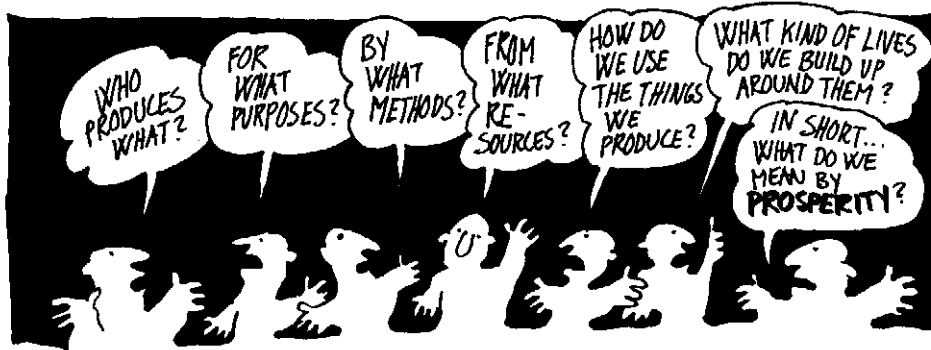
...or can we instead go for a clean bill of health?

Technological development and social development go hand in hand. Today's decisions in the energy field are going to shape lifestyles into the next century...and the effects could be hard to reverse...

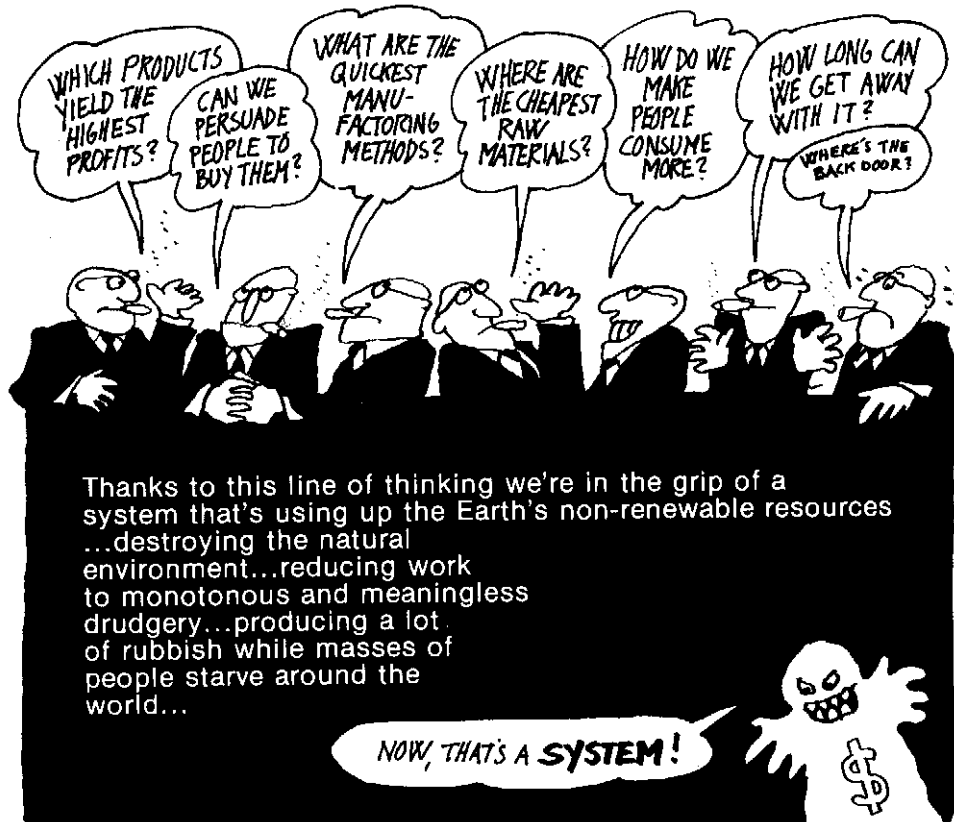
HERE'S ANOTHER KIND OF CHOICE...



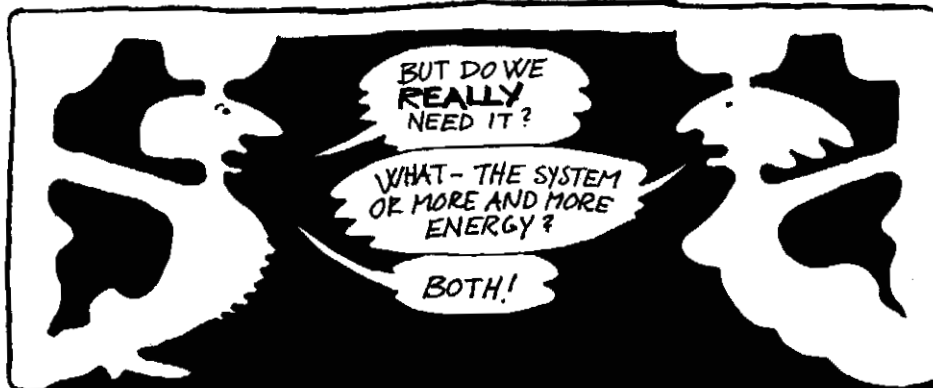
AT THE HEART OF THE PROBLEM ARE QUESTIONS LIKE THESE...



CAPITALISTS ASK A DIFFERENT SET OF QUESTIONS...



IT'S A SYSTEM THAT DEMANDS MORE & MORE ENERGY...



The official line in the industrialised countries is that demand for energy will continue to soar...and that around 1990 it'll outstrip supplies of fossil fuels...creating an **ENERGY GAP** that only the nuke can fill...

IN FACT, THEY SAY, WITHOUT NUCLEAR ELECTRICITY OUR LIVES WILL BE TURNED UPSIDE DOWN BY THE END OF THE CENTURY...



CAPITALISM HAD ITS POINTS...



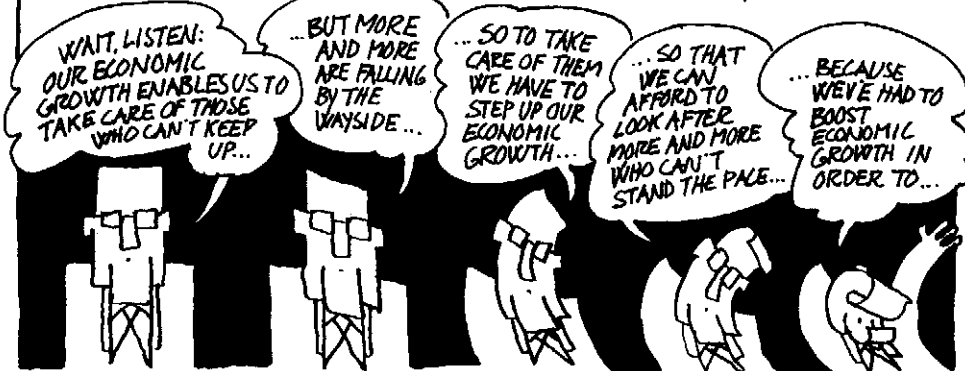
WHAT WE GOT WERE...

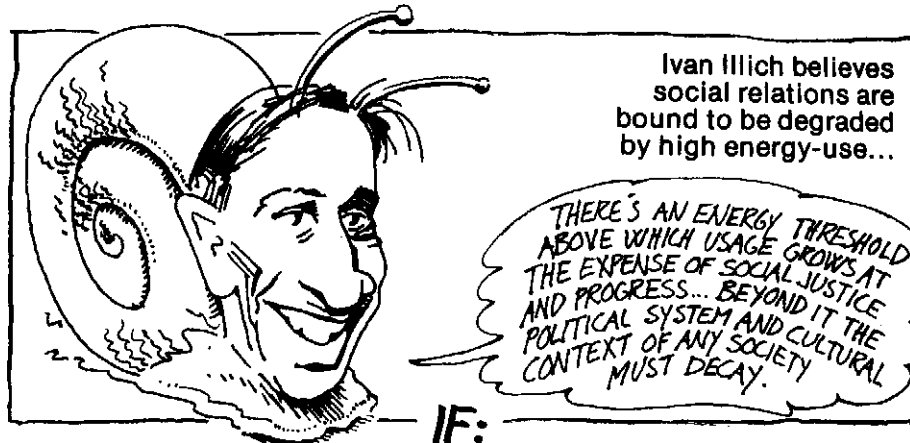
THIS 'STRUCTURAL TRANSFORMATION' ALSO BROUGHT US...

The capitalist market economy has brought *material advantages* to a lot of people...but somewhere along the line...at different times in different places...it out-lived its usefulness...economic growth continued *but there was no corresponding increase in the satisfaction of people's needs...*

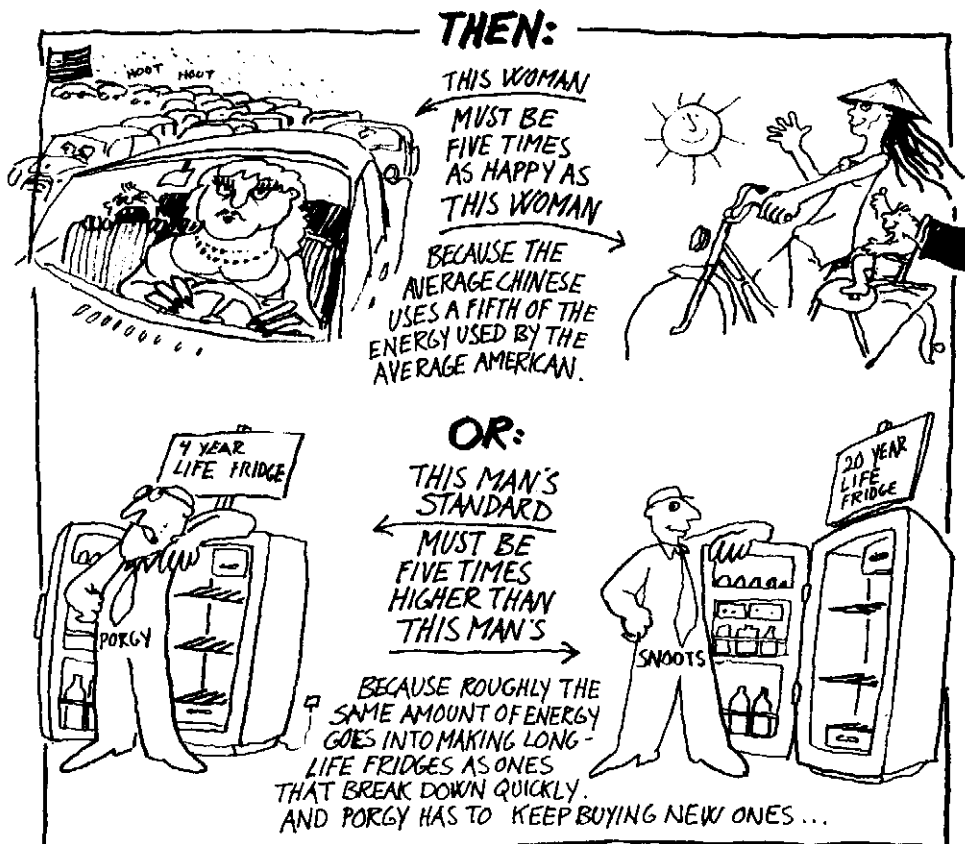
...bigger cities...bigger factories, offices, shops...a faster pace of work...more roads for more cars travelling longer distances to work...greater energy wastage...greater consumption of finite resources...

...more stress at work and alienation outside work...more social problems...more industrial and traffic accidents...more useless products...more artificial environments...more pollution...





IF:
 HIGH ENERGY CONSUMPTION = HIGH LIVING STANDARD =
 = PERSONAL HAPPINESS



⚡ ENERGY USE

A Swedish University study of the relationship between energy use and living standards reached some startling conclusions...

Two-thirds of the total increase in energy use since World War II had been devoured by the 'structural transformation' of society or simply gone to waste!!

Only a third of the increase could strictly be said to have improved the standard of living — better homes, hygiene and health...more leisure travel...construction of social and sports centres...and so forth.

EVEN IF WE COULD MEASURE OUR WELFARE BY THE AMOUNT OF ENERGY WE USE — MEASURING ENERGY CAN BE A MISLEADING BUSINESS...

AMORY LOVINS,
international energy expert:

“How much *primary energy* we use — the fuel we take out of the ground — does not tell us how much energy is delivered at the *point of end use*...for that depends on how efficient our energy supply system is. *End-use energy* in turn says nothing about how much *function* we perform with the energy, for that depends on our end-use efficiency. And how much *function* we perform says nothing about *social welfare*, which depends on whether the thing we did was worth doing.”

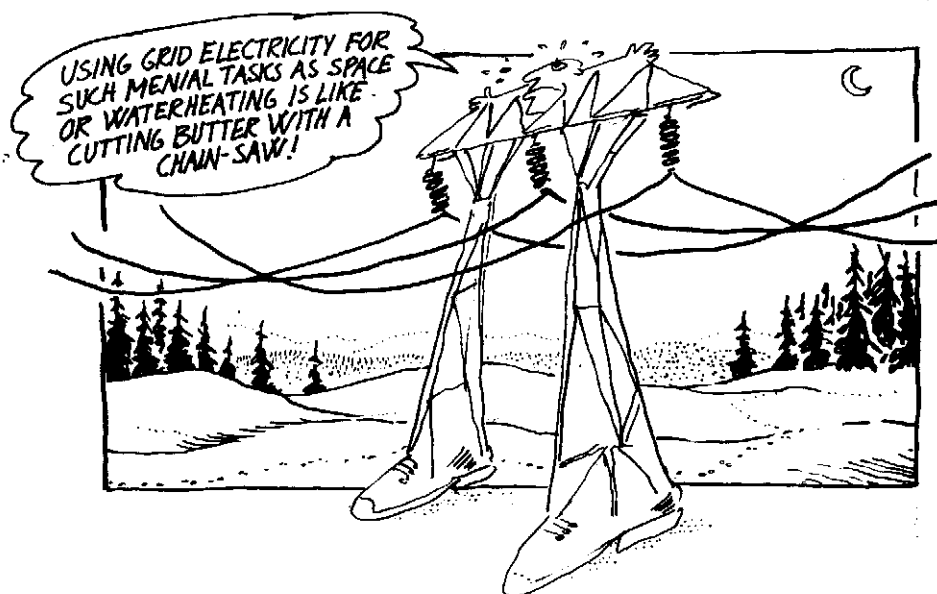


AND MISUSE

The wastage referred to in the Swedish study is mostly what we lose in converting one form of energy (eg coal) into another (eg electricity) and distributing it. These conversion losses are often a result of the **wrong kind** of energy being used for the task in hand...

THE DISTINCTION BETWEEN PRIMARY ENERGY AND END-USE ENERGY IS VITALLY IMPORTANT...IF WE SEEK TO SUPPLY PRECISELY THE RIGHT AMOUNT OF ENERGY IN THE MOST DESIRABLE FORM FOR THE JOB TO BE DONE WE SOON FIND THAT GIGANTIC, INFLEXIBLE POWER UNITS ARE NOT WHAT WE NEED...

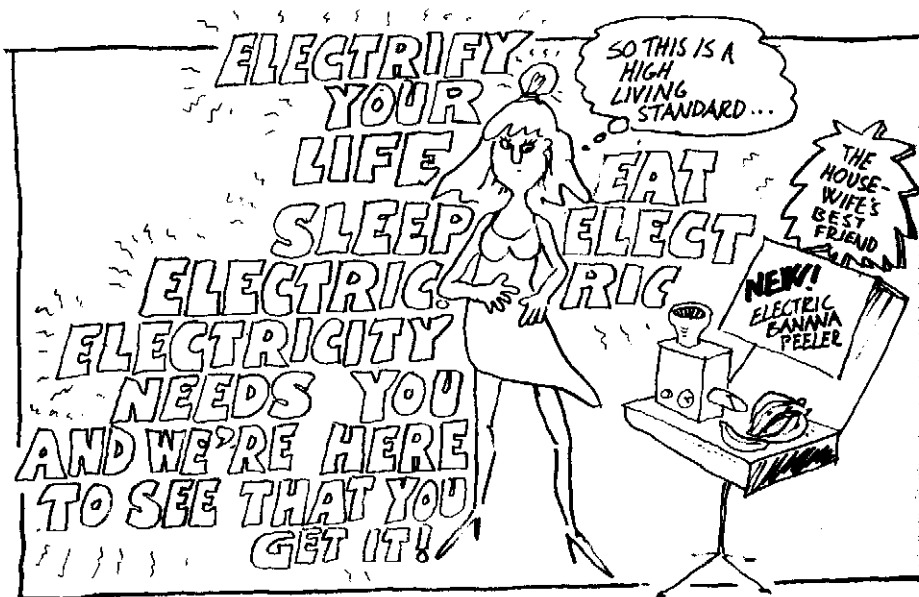
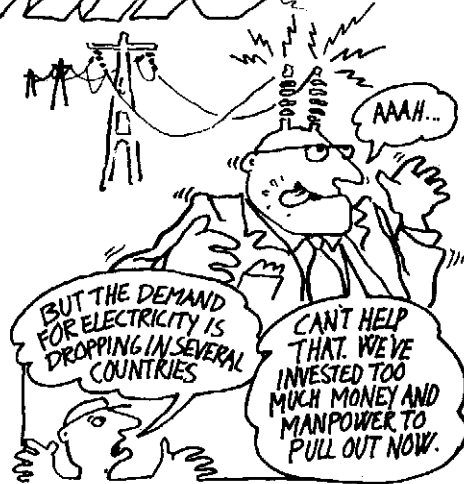
Electricity is not a fuel. It can't easily be stored in quantity. It loses two-thirds of the original energy in conversion. It's a **high-quality** form of power best suited for end-uses such as lighting, electronics, public transport and certain mechanical processes. In industrial countries these usually make up **less than 10% of total energy use**...



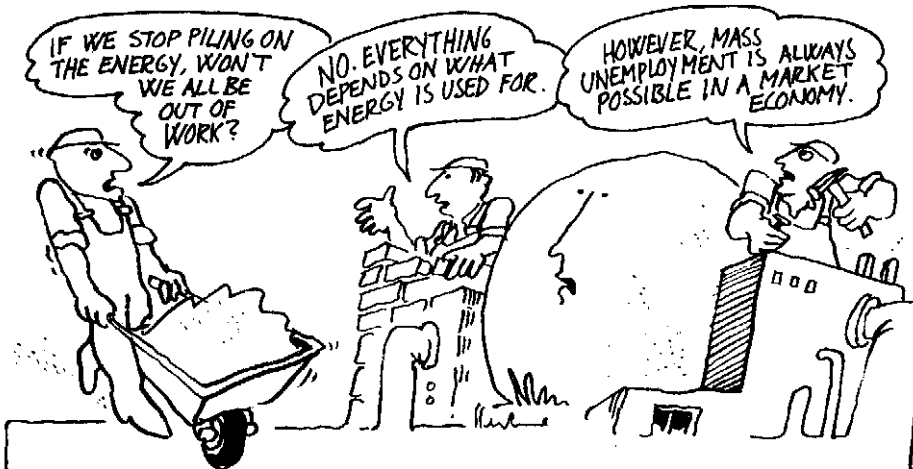
THE **ELECTRIC** FUTURE

The nuclear industry is not interested in things like what kind of energy is best for what purpose...It has to sell nukes to survive...so we have to be made to THINK ELECTRIC...

Energy technologies on the scale of nuclear power can not easily be adapted to cope with changes in society... **society must adapt to them!** They commit us to a certain type of energy and a certain type of lifestyle...like it or not...



REACTORS AND JOBS...



US estimates show that big power stations produce fewer jobs per dollar than just about any other major investment! British estimates show that the electrical supply industry is the most capital-intensive of them all....

Amory Lovins:



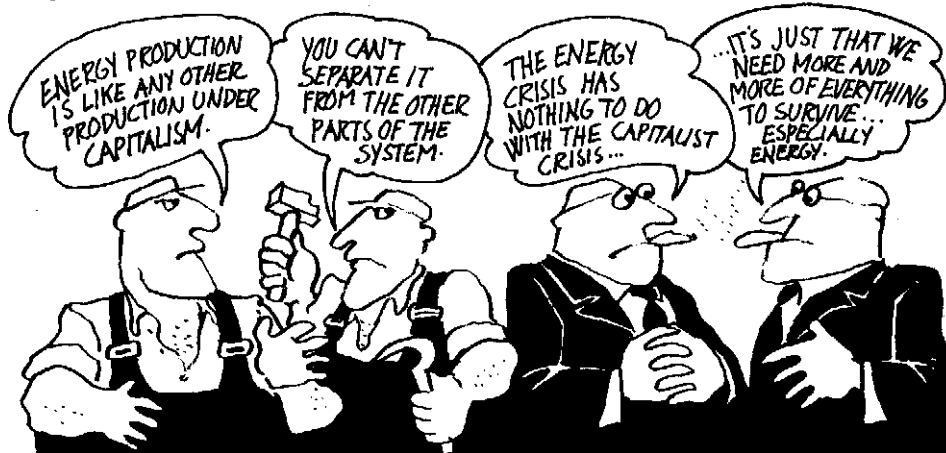
“It's the conservation, solar, environmental and related social programmes that yield the most energy, jobs and monetary returns per dollar invested...

The huge, capital-intensive energy facilities often proposed to relieve unemployment not only make it worse by draining from the economy the capital that could make more jobs if invested almost anywhere else, but also worsen inflation by tying up billions of dollars non-productively for a decade.”

THAT'S HOW LONG IT TAKES TO BUILD A BIG POWER STATION THESE DAYS.

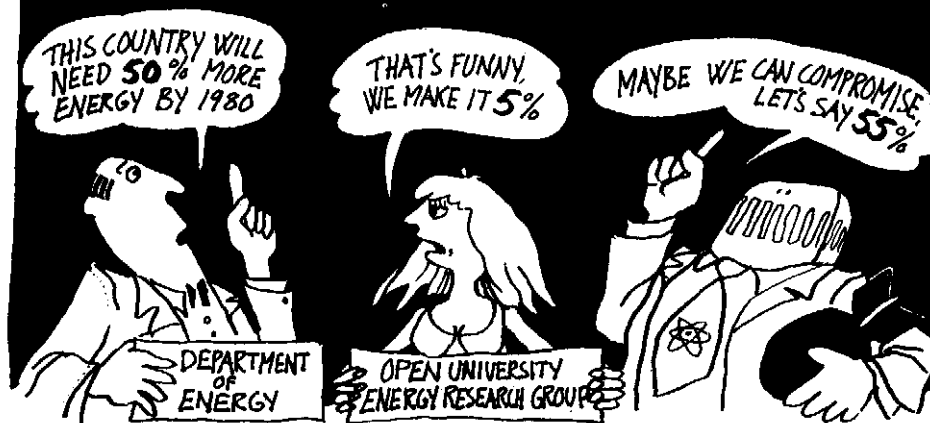


MORE ENERGY = MORE PRODUCTION = MORE EMPLOYMENT ... OR...

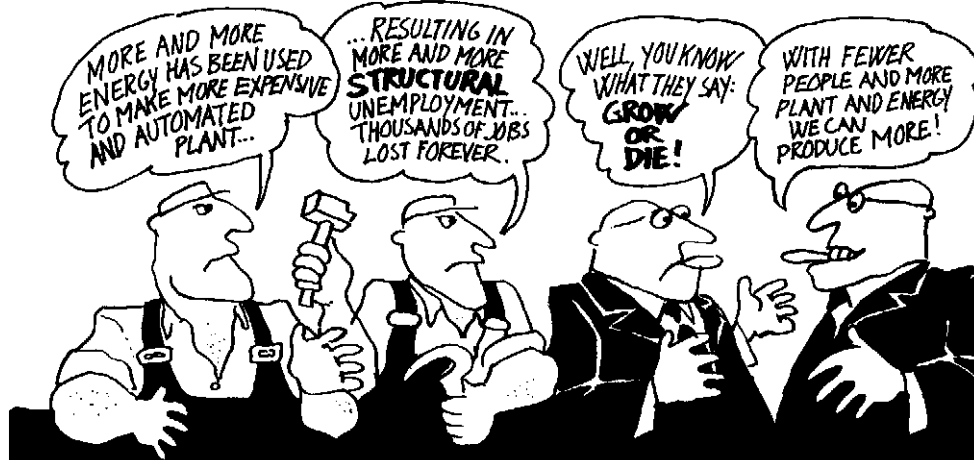


Up to now production and energy consumption have grown more or less in pace...but the connection is not automatic.

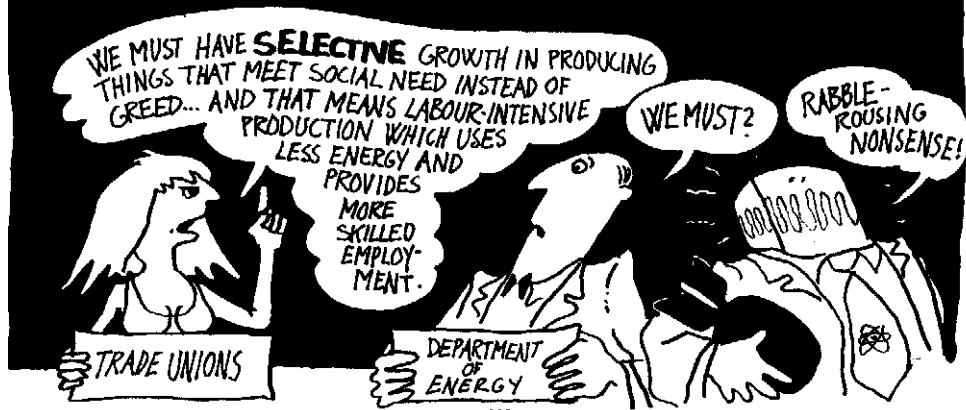
Today energy consumption in many places is static... and energy forecasts are looking less and less reliable. Estimates in the U.S. about future energy requirements vary as much as 500%...and in Britain:



MORE ENERGY = MORE PLANT = FEWER JOBS...

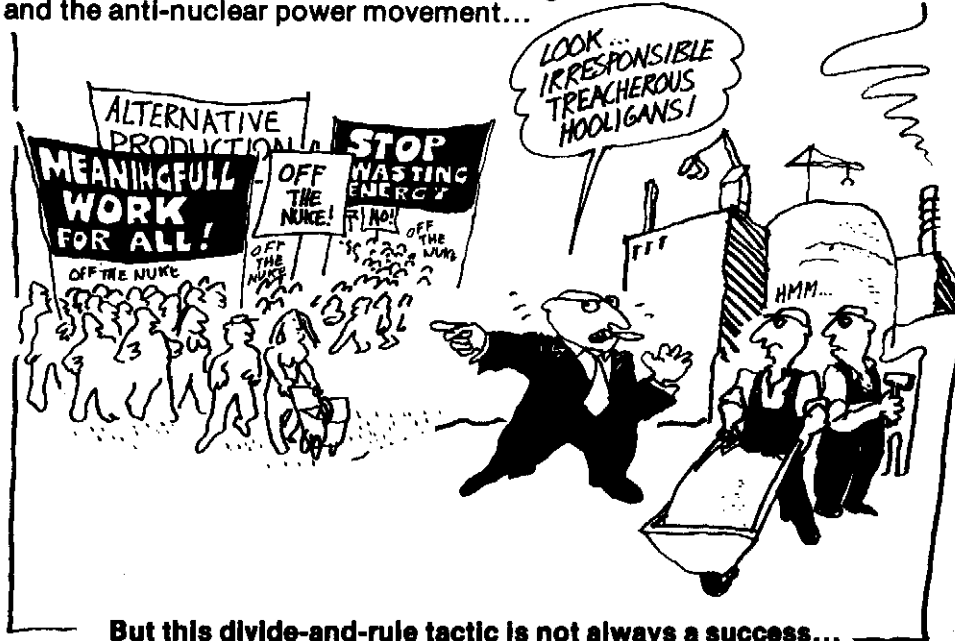


The capitalist economic system needs to sell more and more consumer goods...whether or not people can afford them...and they certainly can't afford them if they're on the dole...



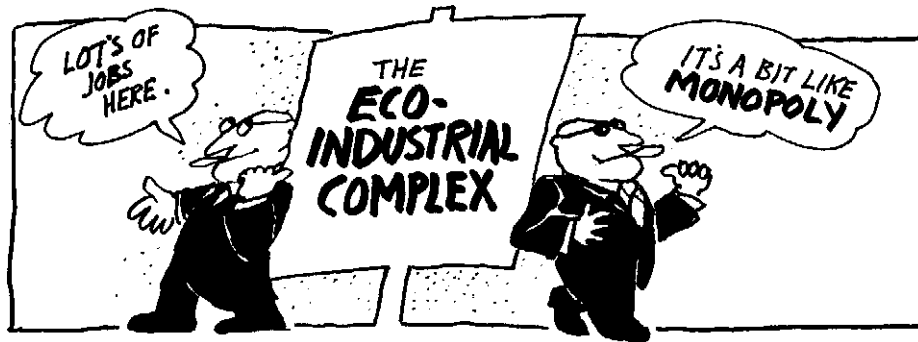
THE LONG AND SHORT OF IT...

Abandoning the high-energy, hard technology approach is going to create *short-term* difficulties for certain groups...for instance workers making nuclear components. In some countries the bosses have jumped at this opportunity to drive a wedge between the trade unions and the anti-nuclear power movement...



But this divide-and-rule tactic is not always a success...





Rules of the Game

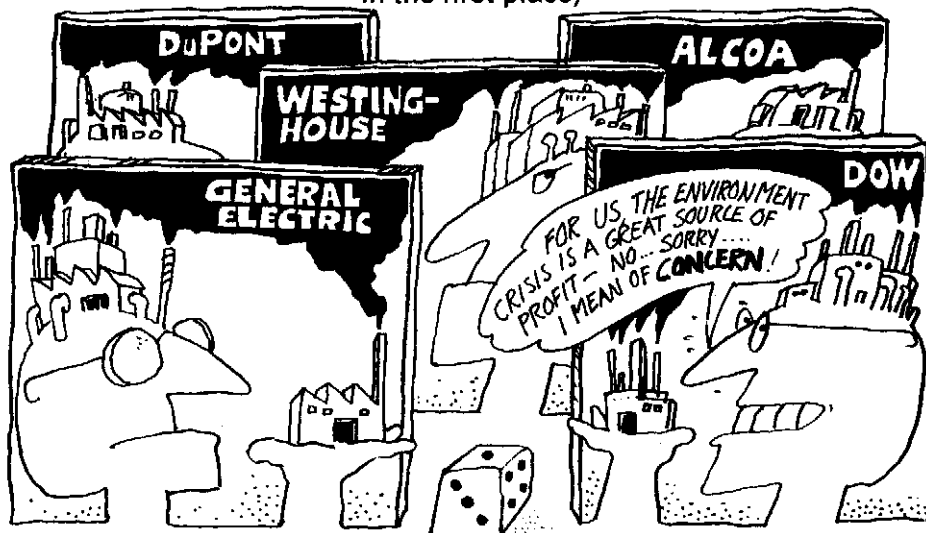
1. You make a product that's profitable but pollutes the environment.
2. You build another factory to make anti-pollution plant & equipment.
3. You sell them to your first factory.
4. You move to another country when the laws get too tough.

Scoring

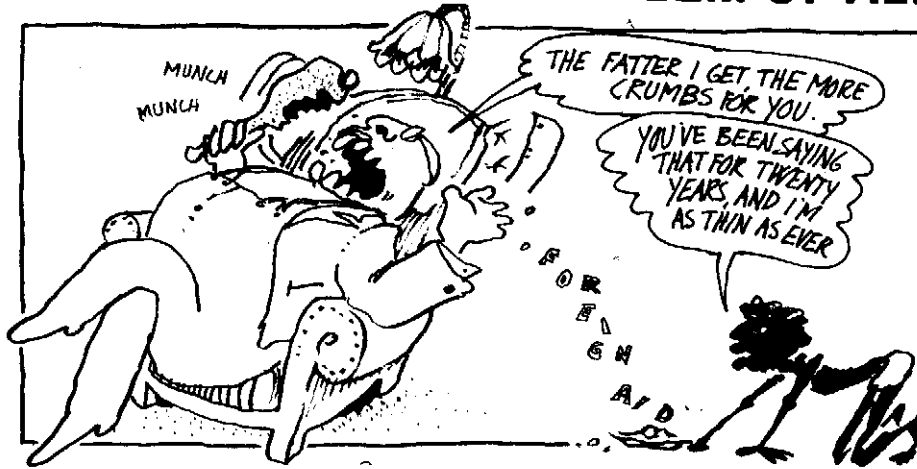
- Extra points for
- * persuading the government to subsidise the clean-up...
 - * safeguarding your profits & your business reputation...
 - * saying you take the consequences of your actions...
 - * moving to the Third World and calling it foreign aid...

The Players

The Multinational Corporations
(who usually made the mess
in the first place)



STARVATION IS THE GREATEST ENVIRONMENTAL PROBLEM OF ALL.



Two-thirds of the global population is starving or close to starvation...

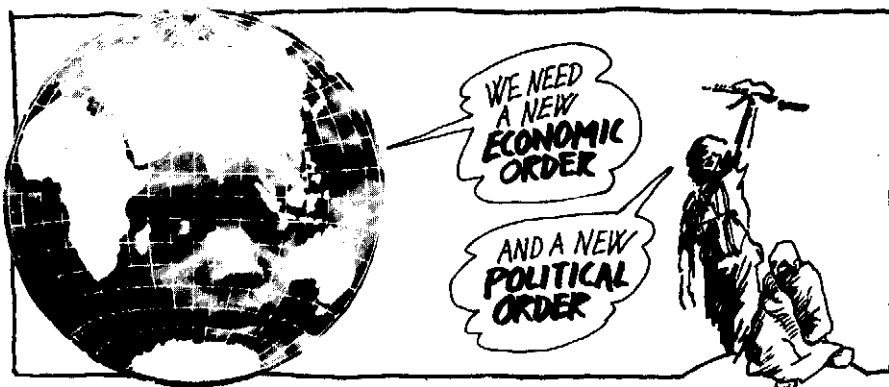
Much of the world's protein resources are used to raise livestock in the rich nations (10 kilos of cereal go into one kilo of beef)...

A third of the world's people — the rich nations — use four-fifths of the world's energy supply...

80% of food exports from the Third World go to the industrialised countries...

Much of the Third World's most fertile land is used to produce tobacco, tea, coffee, cotton and other colonial goods for the rich nations...

Raising the poor nations to today's US energy level would exhaust current oil reserves within a few years...



The Third World situation is a legacy of colonialism... the rich nations built their industrial development on stealing the poor nations' assets...killing and enslaving their peoples...smashing their agriculture and handicrafts...reducing them to 'supplier states' for the advancement of Western Civilisation...



The legacy remains. Many Third World countries have their own flags and parliaments...but they're still 'foreign-owned'...in the 'neo-colonial' grip of the industrialised world...in other words, victims of IMPERIALISM...



So it's a bit futile to imagine it'll all come right in the end if we just keep going as we are and give the poor a little more money and hardware...



TAKE CHINA AND INDIA FOR EXAMPLE...

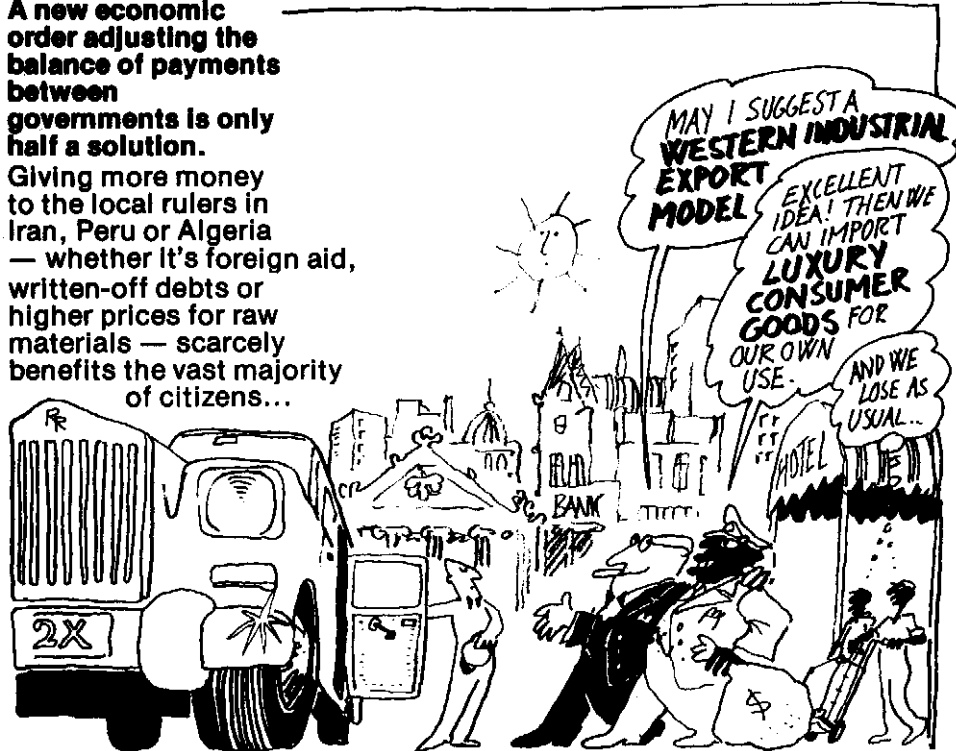
Both were in roughly the same position in the 1940s...starvation...poverty...dependence...but what happened?

INDIA	CHINA
<p>political liberation</p> <p>lots of foreign aid</p> <p>no fundamental changes in the structure of production</p> <p>advanced technology including nuclear power</p> <p>green revolution — eclipse of many small farmers, mass use of chemical fertilisers and DDT for short-term benefits</p>	<p>political and economic liberation</p> <p>little foreign aid</p> <p>many-sided development of industry and agriculture</p> <p>emphasis on simple, small-scale technologies, no nuclear power</p> <p>red revolution — union of peasant, factory worker and technician, more careful use of resources</p>
OUTCOME	
Continuing starvation, poverty and distress...still an under-developed country...	No starvation, considerable equality and no dependence...no longer an underdeveloped country...

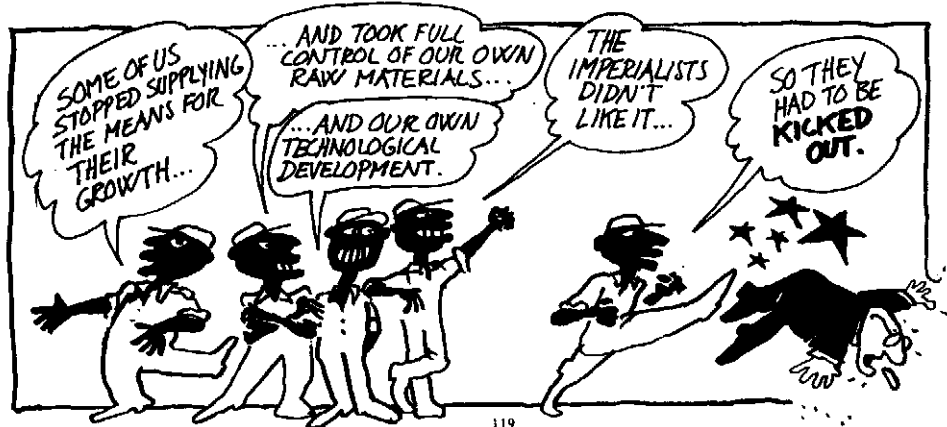


A new economic order adjusting the balance of payments between governments is only half a solution.

Giving more money to the local rulers in Iran, Peru or Algeria — whether it's foreign aid, written-off debts or higher prices for raw materials — scarcely benefits the vast majority of citizens...

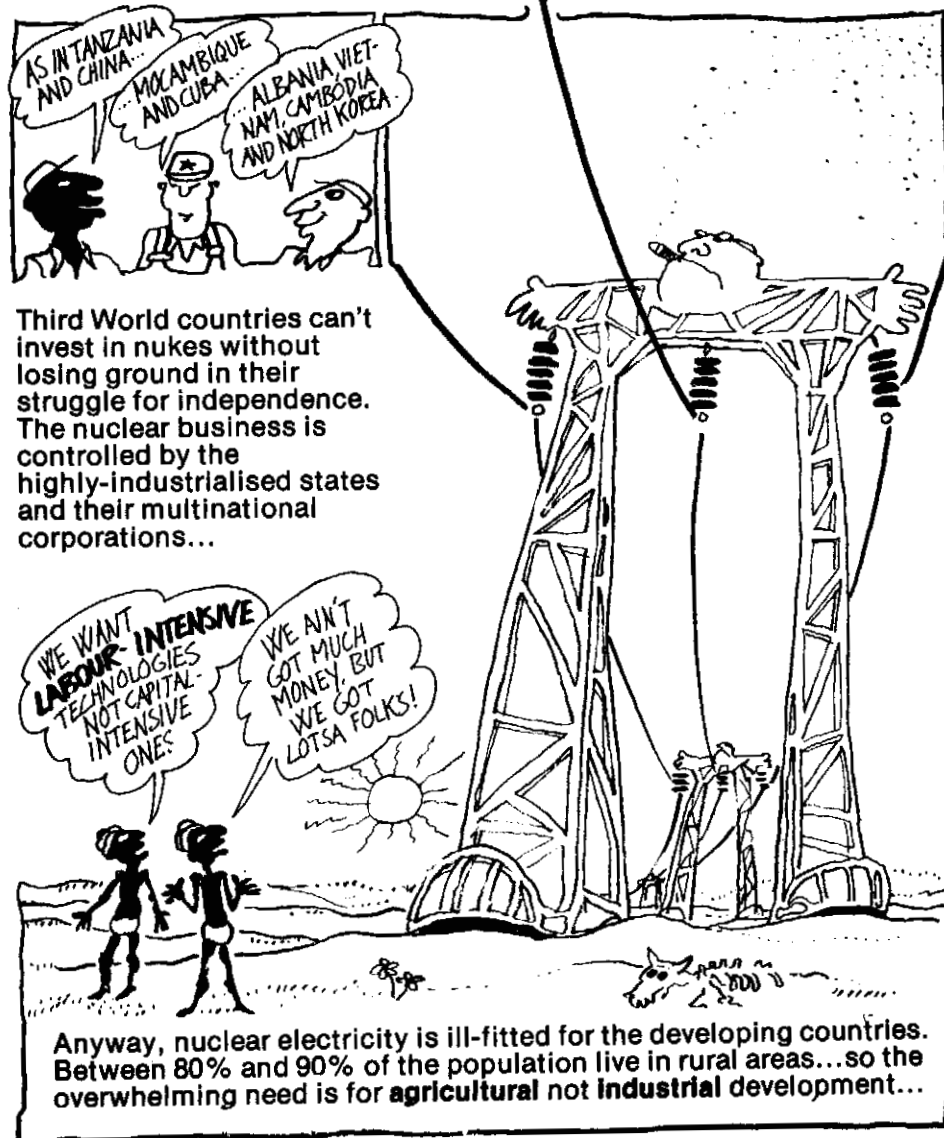


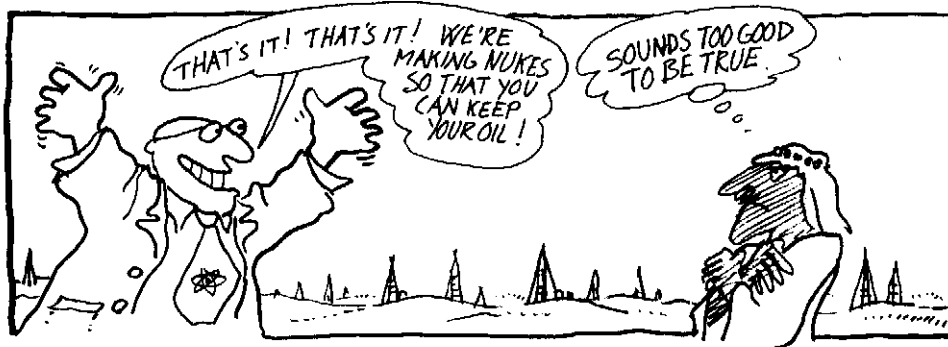
HIGH-ENERGY ECONOMIC GROWTH IN THE INDUSTRIALISED WEST IS BUILT ON IMPERIALISM — THE LOGICAL EXTENSION OF CAPITALISM — AND IT CAN'T BE FRIGHTENED AWAY BY SPEECHES IN THE U.N....



NO NUKES IS GOOD NUKES...

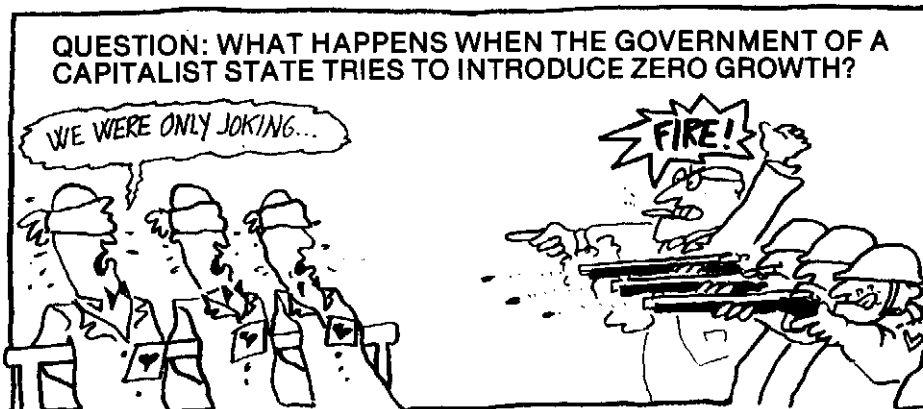
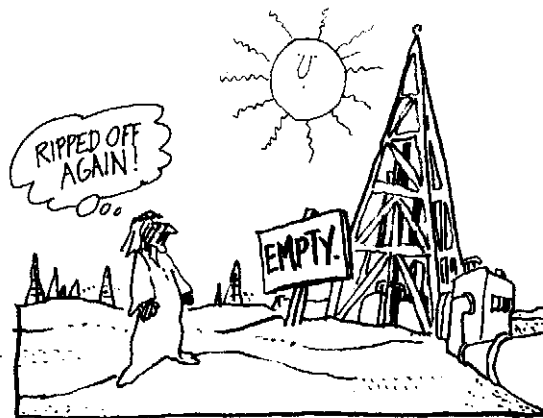
More and more developing countries are going for a system geared to their own resources and needs. It emphasises self-reliance, including 'self-help' technology. It draws on the experience of other countries but is based on the local conditions and traditions...





It is. A glance at energy planning figures shows that the industrialised states are aiming to have *both nukes and oil*! If the growth-hungry West is allowed to rush on down the hard technology road for another two or three decades there won't be much oil or gas left in the ground for those who need it most...

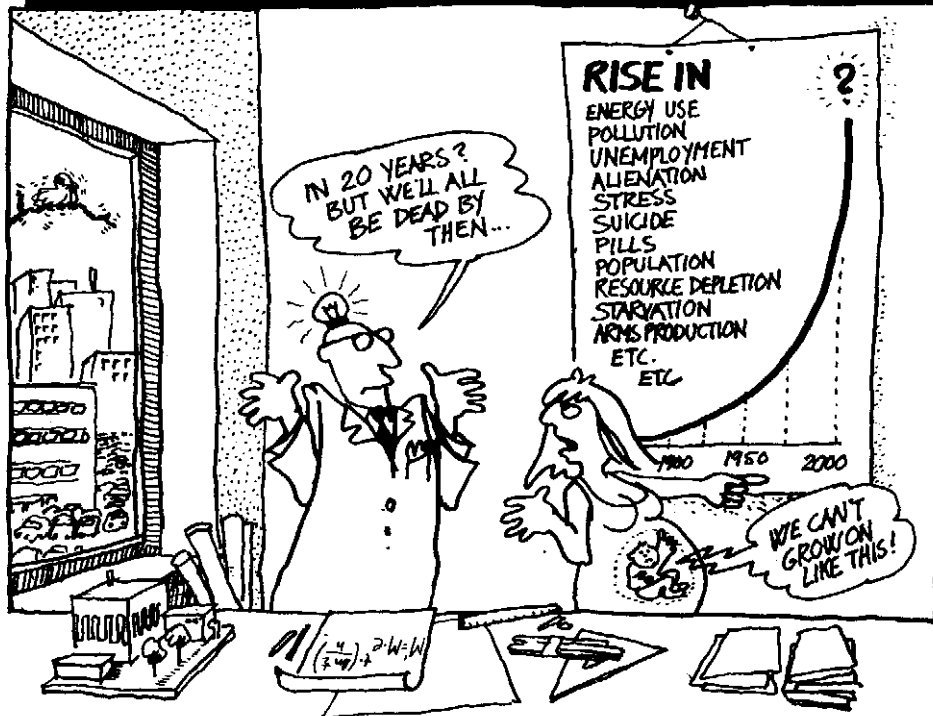
Some western governments are talking vaguely about levelling off industrial growth and energy use. But they're *not* talking about abolition of the market economy. And the market economy demands growth...and more and more cheap energy...



SO IT SEEMS THAT THE HARD ENERGY ROAD
DOES NOT LEAD TO

BETTER LIVING STANDARDS...
MORE EMPLOYMENT...
GLOBAL EQUALITY...

ON THE CONTRARY...

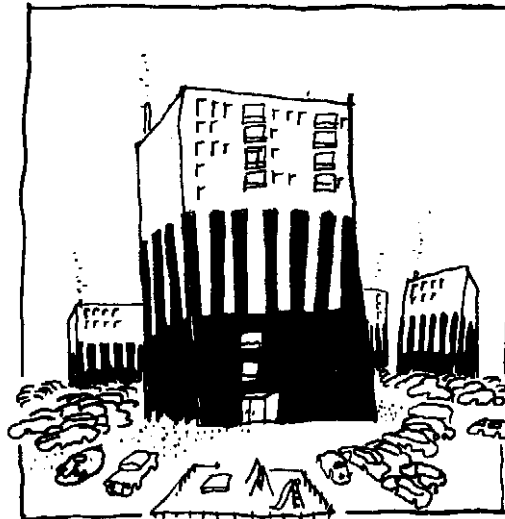


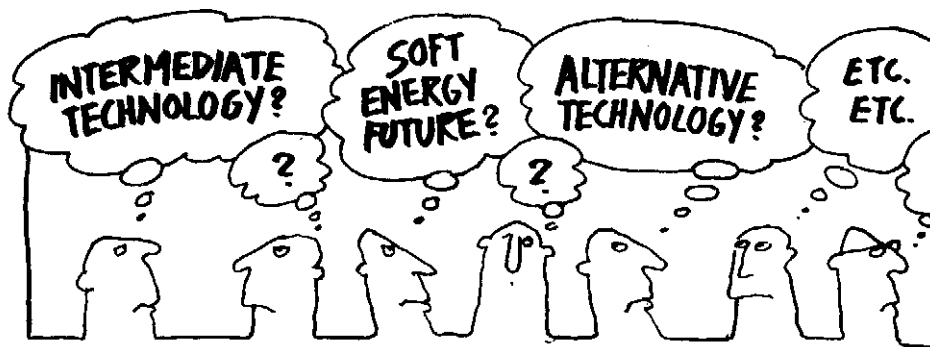
FORTUNATELY
THERE IS AN ALTERNATIVE...

...FOR RICH AND
POOR NATIONS
ALIKE...

AND SO TO CHAPTER 7.

In which resources are husbanded,
energy is renewable, decision-making
is shared and a Soft Energy Future
seems the only rational course...





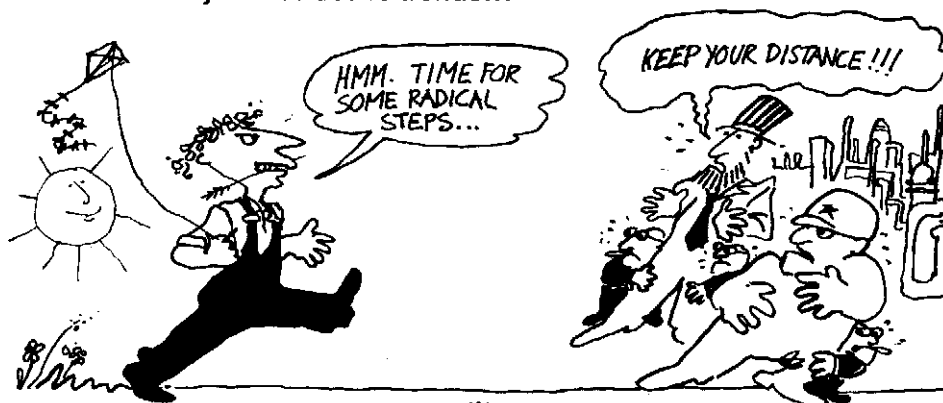
**THE ALTERNATIVE SOCIETY
GOES UNDER MANY NAMES...**

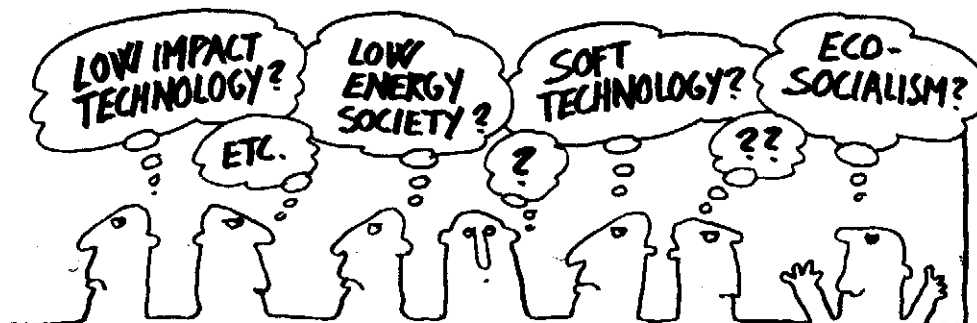
And takes many shapes. No single model fits everywhere. In fact, it's not so much a question of models as a strategy for change at various times with specific goals in mind...



Tactics vary. Some people think the profiteers can be reformed...that the ruling élites can be talked out of their privileges...that national parliaments can control multinational monopoly capitalists. Some think the environment crisis can be dealt with by juggling prices and tariffs...

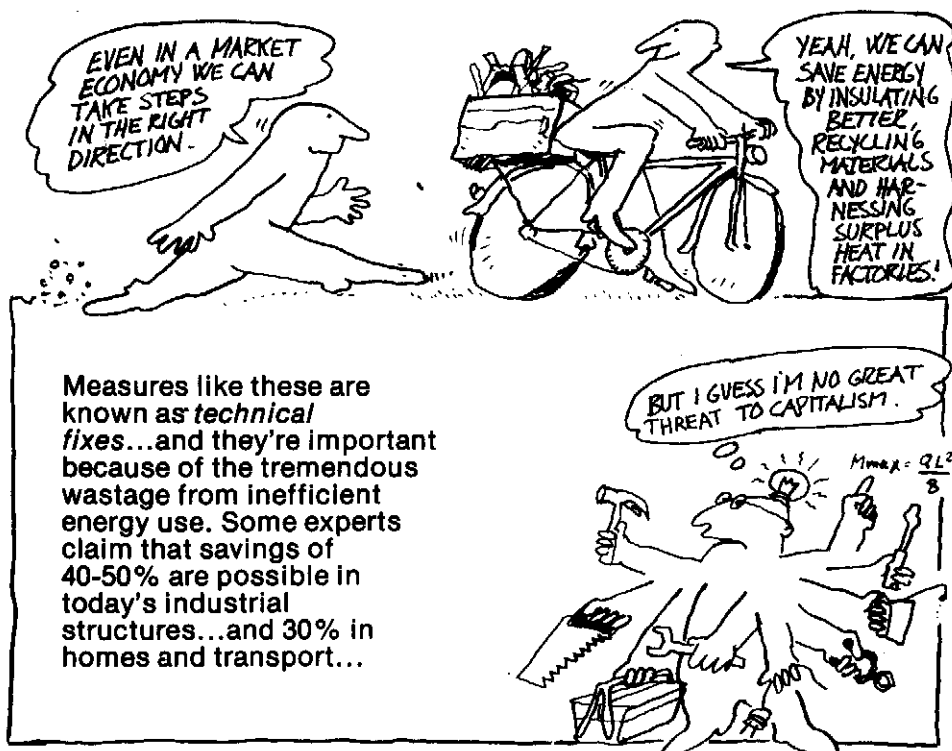
But the idea is growing that only a socialist blueprint for change can reverse today's destructive trends...





THE ALTERNATIVE GOALS...

- § Switch-over from fossil fuels to renewable energy forms...
- § Conservation of natural and human resources...
- § Global solidarity...
- § Meaningful production and work for all...
- § Grass-roots government...





Changing over to the naturally-distributed energy sources is ecologically essential. But they can be developed in different ways...

THE MALIGNANT WAY

To prop up the centralised and authoritarian structures of our existing industrial society...

FOR EXAMPLE THERE ARE PLANS AFOOT FOR:

A vast solar power station in orbit beaming energy to Earth by microwave...

PRETTY NEAT WEAPON FOR RADIATING PEOPLE

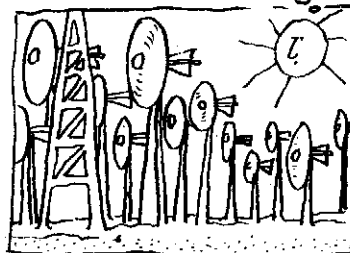


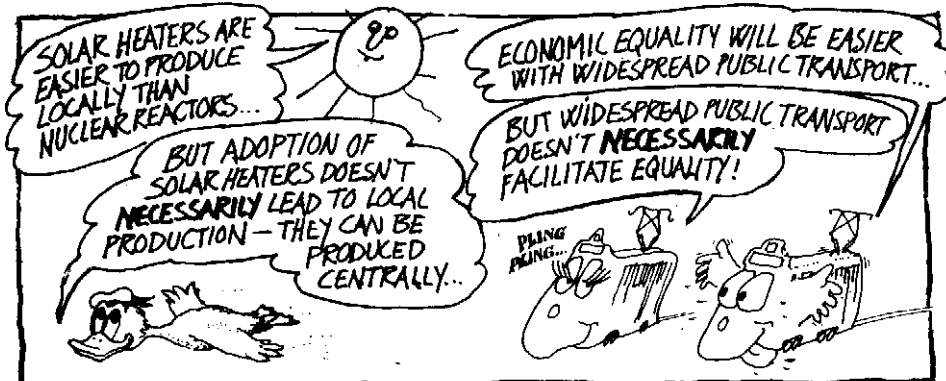
THE BENEVOLENT WAY

To promote the decentralisation of political and economic power, redistribution of wealth and the liberation of the individual...

A gigantic battery of 300,000 wind turbines on the American Great Plains...

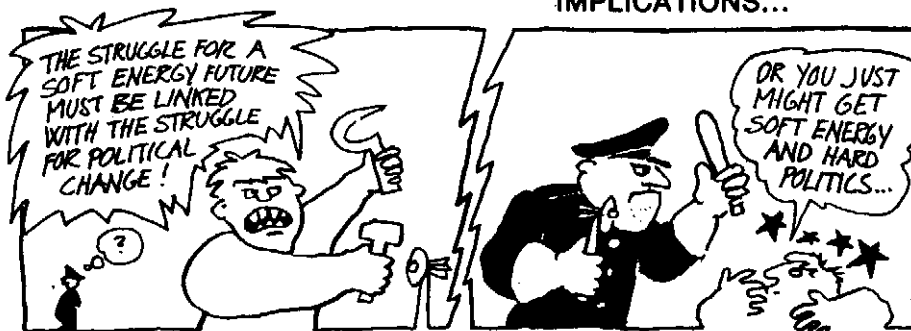
OWNED BY CON EDISON?



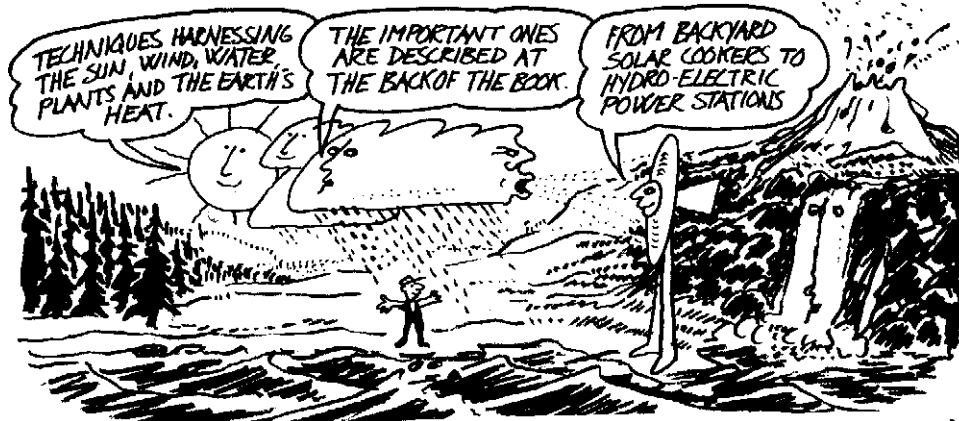


SO IT'S NOT JUST A QUESTION OF HARD OR SOFT...HIGH OR LOW...BIG OR SMALL...

ANY ENERGY STRATEGY MUST ALSO BE JUDGED BY ITS POLITICAL AND ECONOMIC IMPLICATIONS...



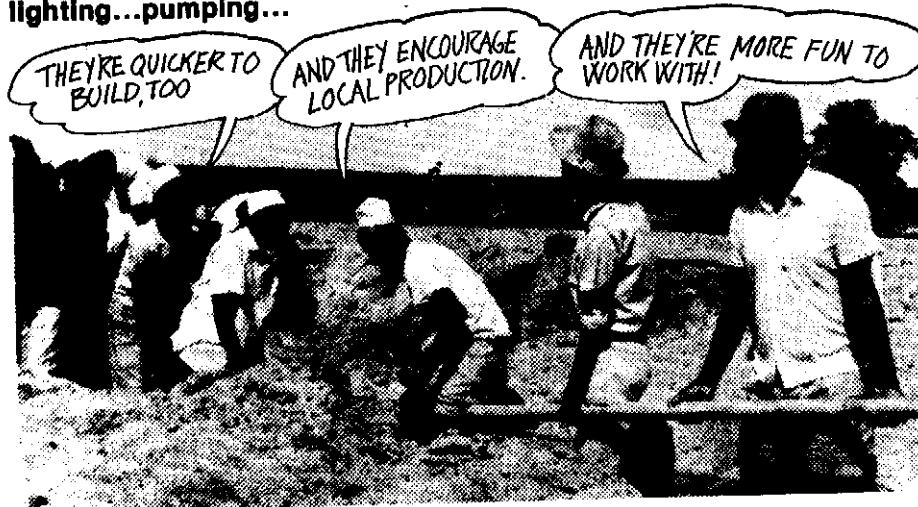
WHAT ARE THE SOFT ENERGY SYSTEMS?



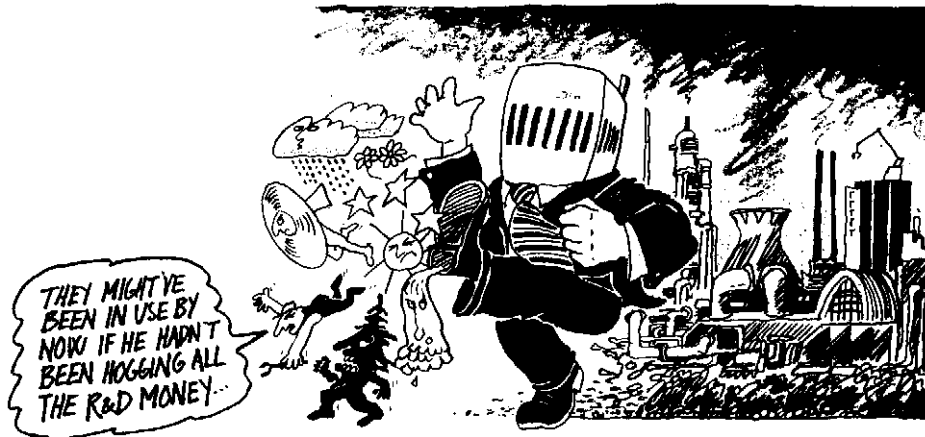
The strength of the 'soft energy path' is its flexibility...It's a mixture of the very many techniques directly suited to people's varying energy requirements...Lovins describes them like this:

“ They are diverse, so that as a national treasury runs on many small tax contributions, so national energy supply is an aggregate of very many individually modest contributions, each designed for maximum effectiveness in particular circumstances...”

They're especially suitable for Third World development because they directly satisfy the basic human needs...heating...cooking...lighting...pumping...



WHEN WILL THEY BE AVAILABLE?



The picture is changing fast... a few years ago we were told the soft energy systems were of marginal interest...now the Worldwatch Institute in Washington says sunlight can supply 40% of the world's needs by the turn of the century...and a British study says we can all be living on the renewable energy sources within about 75 years...

TODAY MANY GOVERNMENTS ARE EMBARKING ON ALTERNATIVE ENERGY PROGRAMMES...AND IT'S THE NUCLEAR INDUSTRY THAT'S HAVING TO CHASE FUNDS...

EXERCISE IN DOUBLE MORALITY

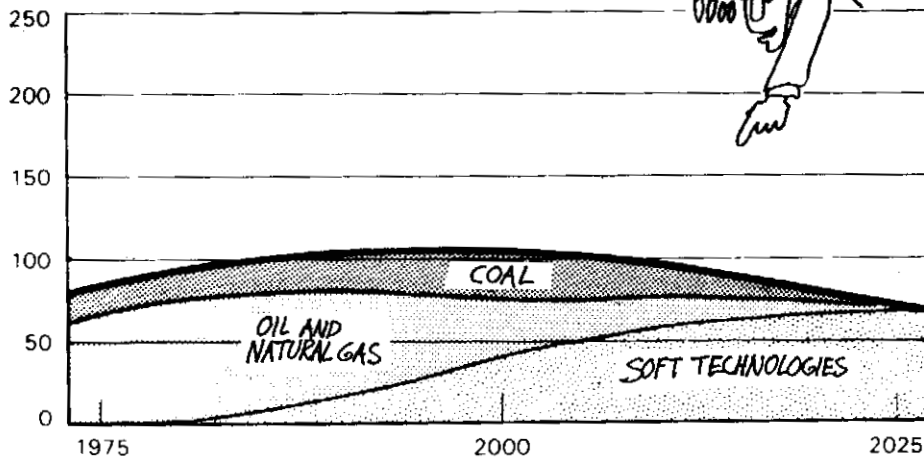


THE FOSSIL-FUEL BRIDGE...

To get to the stage where we can live on our energy **income** we'll have to keep drawing on our energy **savings** a while longer... half a century or more in the West...much less in the Third World...

THIS LEVELS OFF WITH IMPROVED ENERGY QUALITY AND EFFICIENCY AT POINT OF USE.

SOMETHING LIKE THIS...



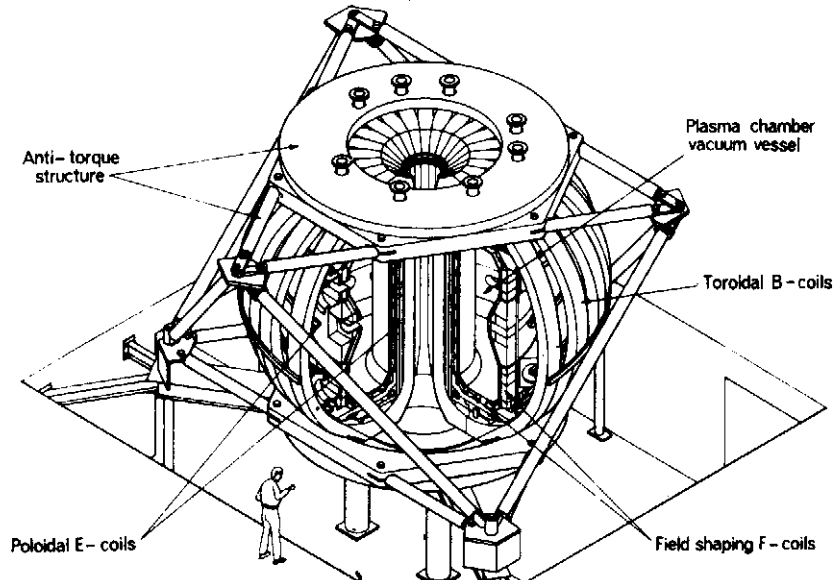
Phasing out oil and natural gas means a *brief increase* in the use of coal, which is 25 times as plentiful. It has mainly been used to produce electricity and steel so far...but coal technology is undergoing a bit of a revolution these days and looks likely to replace oil in many respects...



THE FISSION-FUSION FANTASY...

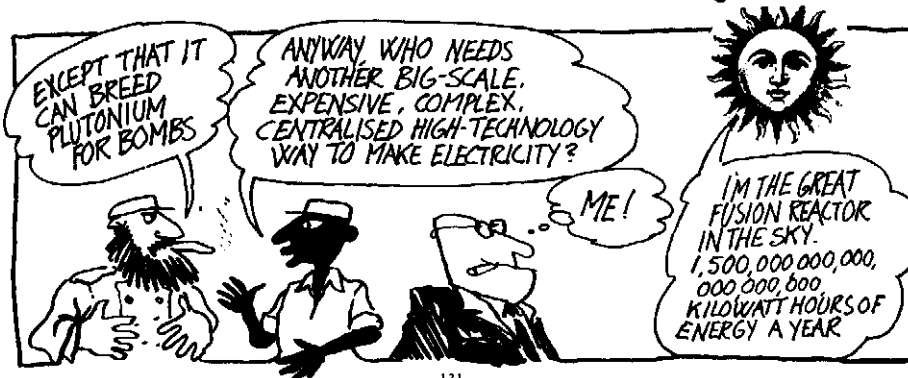
The nuclear industry prefers another alternative — a *fission bridge*...which means the hard technology path...which means more and more energy...more wastage...more electricity creating a need for more nukes...breeders...super-breeders...and finally...

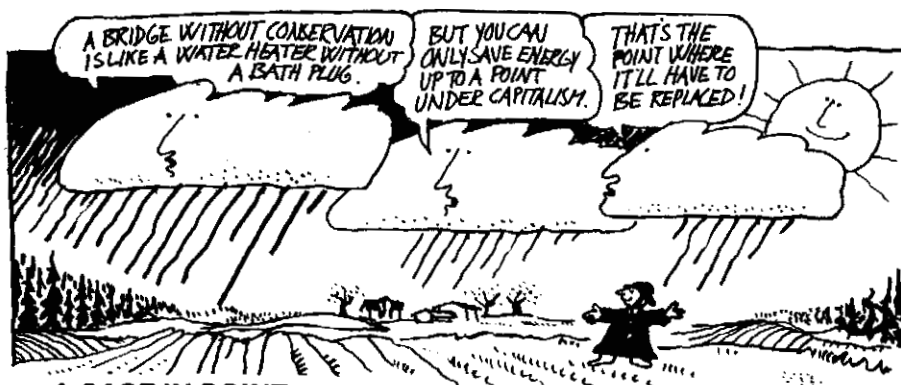
THE GREATEST NUKE OF THEM ALL



The FUSION REACTOR

It slams together atoms instead of splitting them. Its raw materials are lithium and deuterium. A fusion reactor would be colossal...starting at 3,000 MWe...and make fission reactors look cheap to build. But the industry says it will be more economical to run and less dangerous...





A CASE IN POINT

Motor-cars are just about the worst energy-wasters around... One remedy is to improve engines so that they use fuel more efficiently. Another is to make cars last 30, 40 or 50 years so you don't need to keep making new ones...



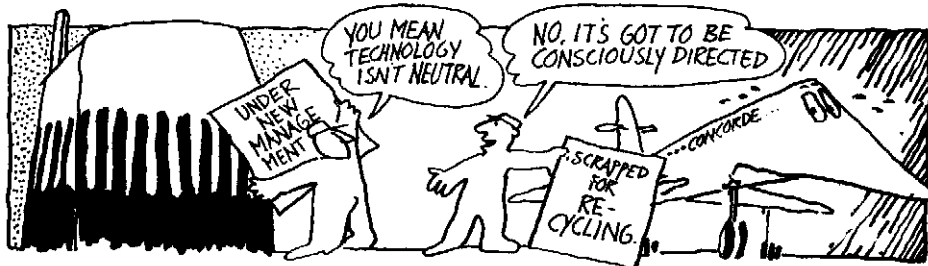
Even better, do both and shift the emphasis from private motoring to public transport... less vehicles, less fuel, less raw materials, less energy... and less pollution!

BEST OF ALL: DECENTRALISE SOCIETY SO THAT PEOPLE LIVE WITHIN EASY DISTANCE OF THEIR FRIENDS AND WORKPLACES!

THAT'S A LONG-TERM GOAL... AND LIKE THE SWITCH TO COLLECTIVE TRANSPORT IT CAN SCARCELY BE ACHIEVED IN A MARKET ECONOMY...

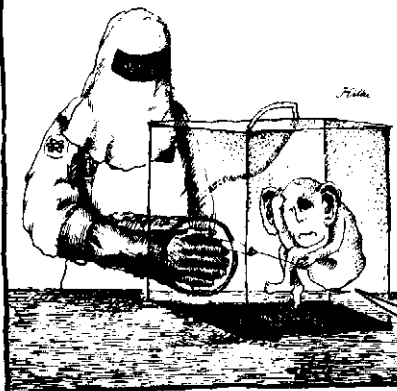
A lasting solution of the resources problem requires careful planning of energy use, work patterns and products...social equality requires humanised production under workers' and consumers' control...a system attuned to people's real needs...not shaped by the manipulated 'demands' of passive consumers...

BUT SUBSTITUTING A PLANNED ECONOMY FOR A MARKET ECONOMY IS NOT THE ULTIMATE GOAL...ONLY A PRECONDITION FOR REAL CHANGE...



In today's market economies science and technology is largely owned and controlled by the capitalist multinationals and serves their social, political and economic goals...

In tomorrow's planned economies research and development must be strongly focused on things like public transport, socially-useful products, soft energy techniques, recycling and safe workplaces...



UNPLANNABLE ECONOMIES AND UNECONOMIC PLANNING...

Calls for some form of planning are now being heard from economic experts in such capitalist strongholds as Britain and the United States...without much success...



AND THAT GREY OLD KREMLIN CROWD ISN'T MUCH OF AN INSPIRATION!

The Soviet experiment went off the rails long ago...today it's more or less a parody of socialism...a centralised, authoritarian, bureaucratic and energy-hungry society riddled with nukes...



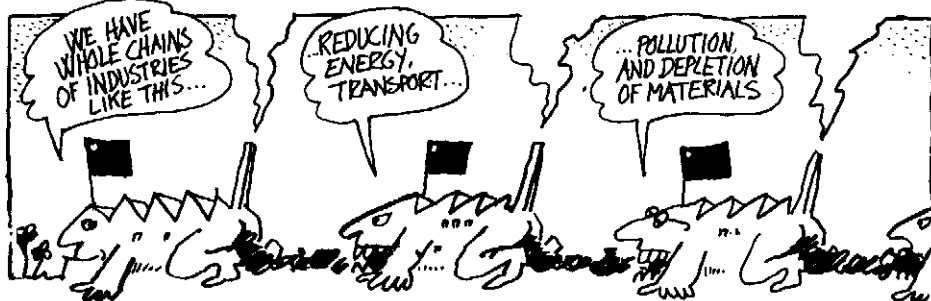
THE CHINESE EXAMPLE

Of existing societies, China has come closest to the soft energy model. Mao Tse-tung stressed the importance of local initiative and striking a balance between agriculture and industry, city and countryside, worker and student...



CONSERVING RESOURCES IN A PLANNED ECONOMY *The Disappearing Waste*

The waste product from one factory is raw material for another...so you site the second industry next door from the start...and its surplus is used by a third...and so on...

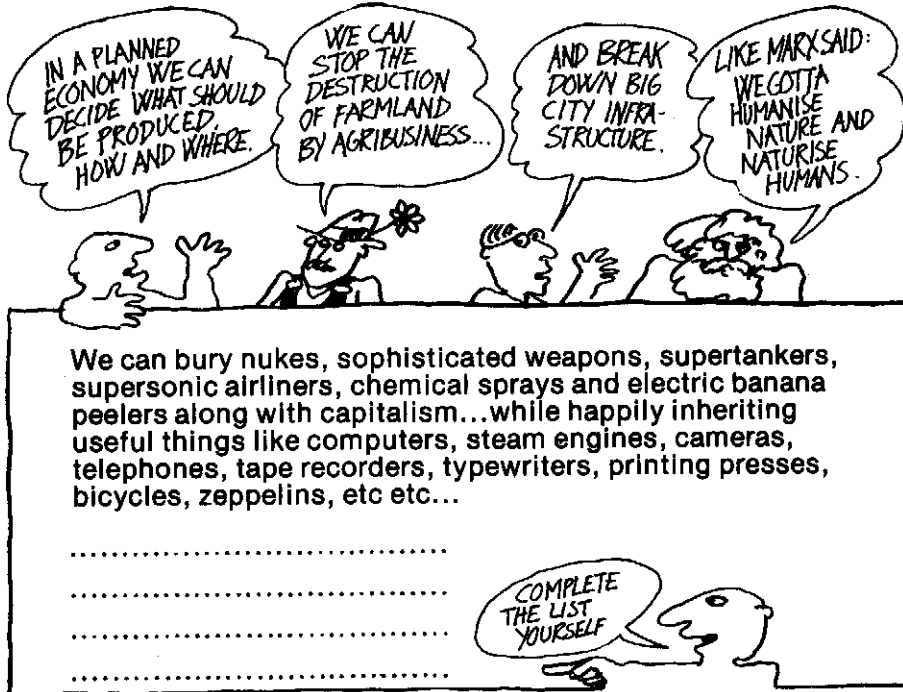


For years, China has been a display window for alternative, ecologically-viable techniques...and has proved that people's individual and collective resourcefulness can work wonders in the proper setting....



WALKING ON TWO LEGS....

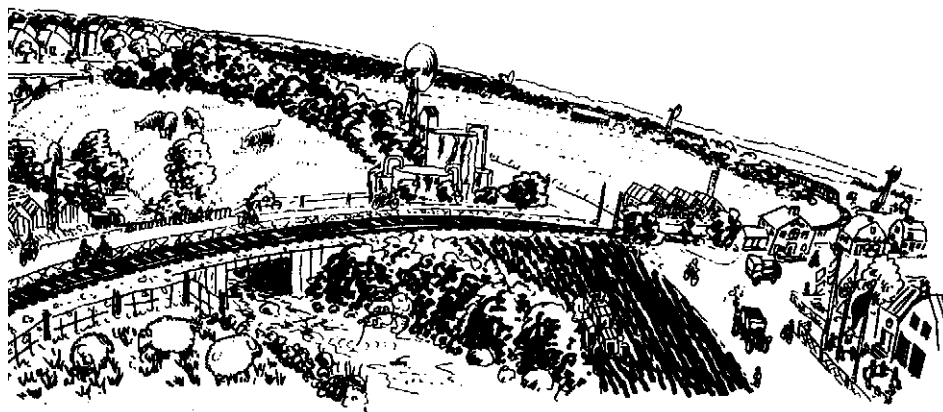
The Chinese policy of mixing big scale and small scale, local and centralised, urban and rural, mental and manual, can also be applied to industrialised societies... approaching the problem from the other direction... learning from our mistakes...



The practical circumstances are hard to foresee... But someone had a crack the other day in a British radical science journal, Undercurrents...



<p>Large and small-scale sun, wind, water, geothermal etc energy usage. Collective digestion of all organic wastes for methane. Total energy systems and district heating. Heat pumps, hydrogen and methanol as basic fuels. Central electricity generation from many different sources with local grids. Fuel cells. Controlled exploitation of abundant resources. Advanced, autonomous houses outside the cities, mostly of large size. All the main industrial materials, although not in overwhelming abundance. Wide range of special steels and plastics. Semi-conductors and electronic bric-brac. Some computers, radio, telly etc. Much automation in tedious production jobs. Litho-presses. Proper R & D. Knowledge firmly based on the traditional sciences. Tractors. Combines etc. Machines for</p>	<p>More even... Many more in... production. Health food at mass food distribution. Some meat. Trains. Public transport. Dirigibles. Few planes. Some long-distance travel but less commuting. Strong controls on environmentally harmful substances. Very strict emission standards. Less mining, with improved work conditions. Controlled distribution of raw materials. Careful conservation programme. Equipment designed for reliability, ease of repair, long life and recycling of components. Smaller range of consumer goods. Wider range of living patterns and possibility for greater variety within a person's life. Life-long education-and-work. Regional emphasis within a national and international economy. ETC...</p>
--	---



EVERYONE RULES OK?

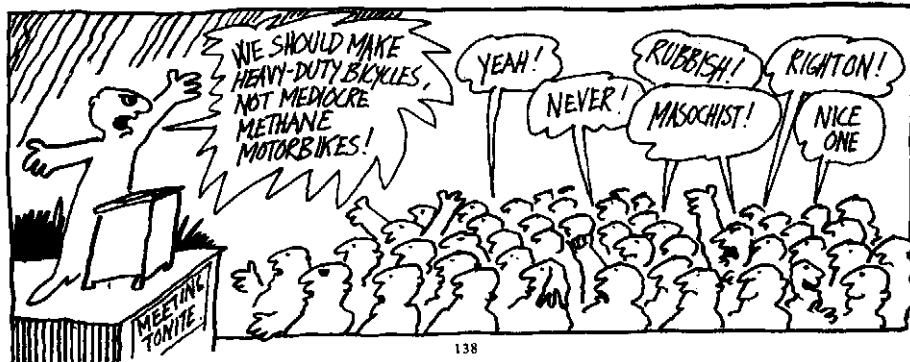


DRAFT PROPOSAL

1. Creation of committees or *councils* at local factories, housing estates and other places where people gather...
2. Council members directly elected and subject to immediate recall if they abuse responsibilities...
3. Local councils elect councils for larger units and regions...
4. Overall co-ordination...mmm...difficult...what about a directly-elected national planning body aided by council working groups with specialised fields?



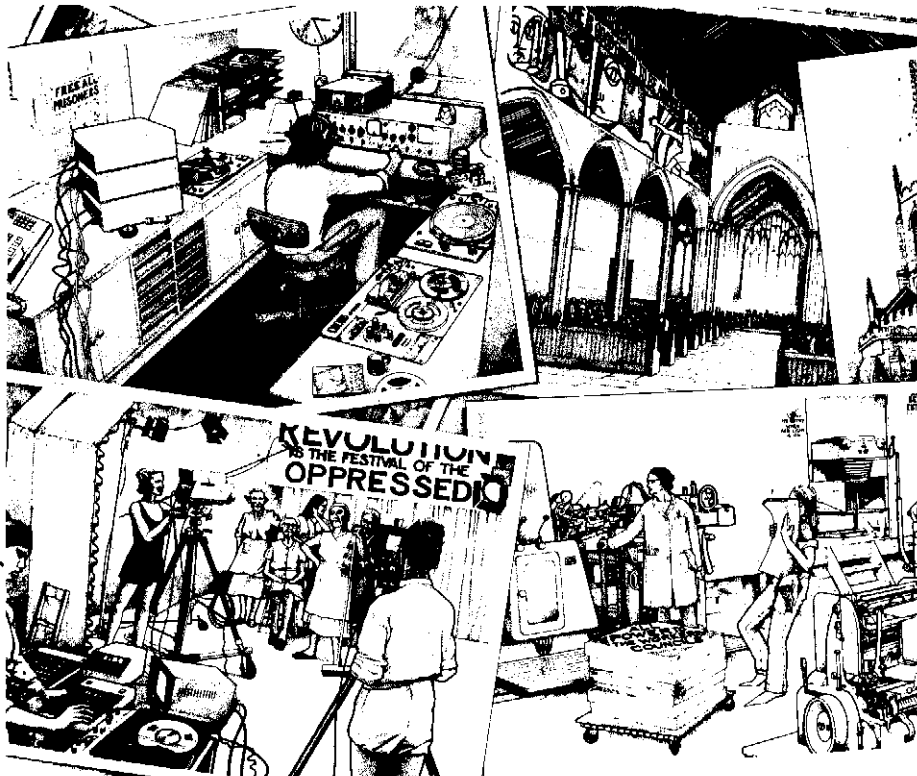
5. Factory councils decide the conditions of work — job safety, division of labour, rotation of work...
6. They cooperate with other council groups in determining the future course of production...



In living areas, neighbourhood councils could be responsible for housing management, local trading, day nurseries and recreation facilities...they could sound out local opinion on what consumer goods should be produced and distribute these in the district...



Civil rights are underpinned by widespread public involvement in mass communication, for example at community media centres...



COMMUNITY MEDIA CENTRE

THIS VIDEO PICTURE BY CUPPEDIA (PUBLISHED BY) WAS PROVIDED BY THE UNITED STATES GOVERNMENT. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE UNITED STATES GOVERNMENT.

CHOOSING THE SOFT ENERGY PATH AND RECOGNISING THE PHYSICAL AND BIOLOGICAL CONSTRAINTS ON HUMAN ACTIVITY DOESN'T MEAN FREEZING IN THE DARK...

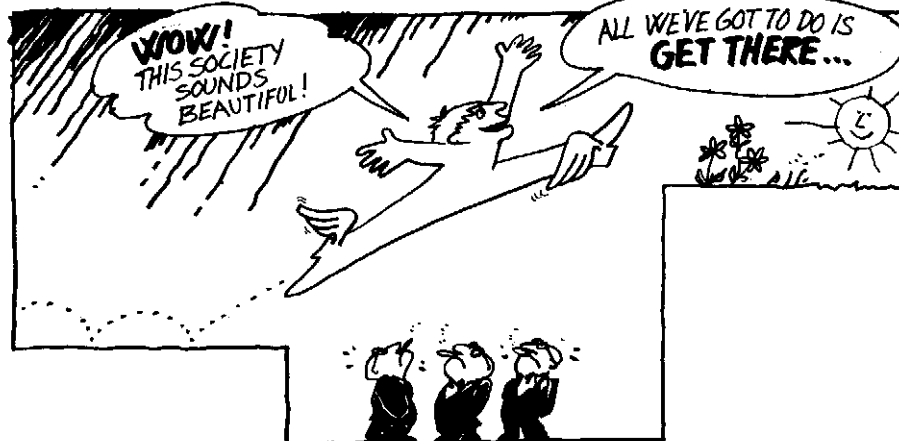
It means choosing a *reasonable* material standard and a *reasonable* level of energy use instead of growing inequality and alienation...It means placing greater value on things that *count* instead of things that are merely *countable*...



**We're all basically creative...
It's only when we're not given
responsibility or the tools to
control our own lives that we
become passive, violent,
neurotic...**

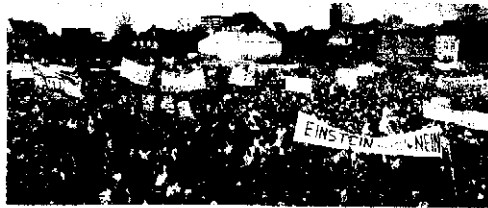


**Active people who like to
experiment and solve
problems are not easy to
oppress... they develop the
self-confidence that is the
lifeblood of real
democracy...they don't need
to be mobilised, led, ruled or
watched over...quite literally,
they're capable of taking
matters into their own
hands...**



AND FINALLY: **CHAPTER 8.**

In which the environmentalists start the ball rolling, the workers tackle them, both revise their ideas and just about everyone joins the anti-nuclear struggle...





HELL NO, WE WON'T GLOW...

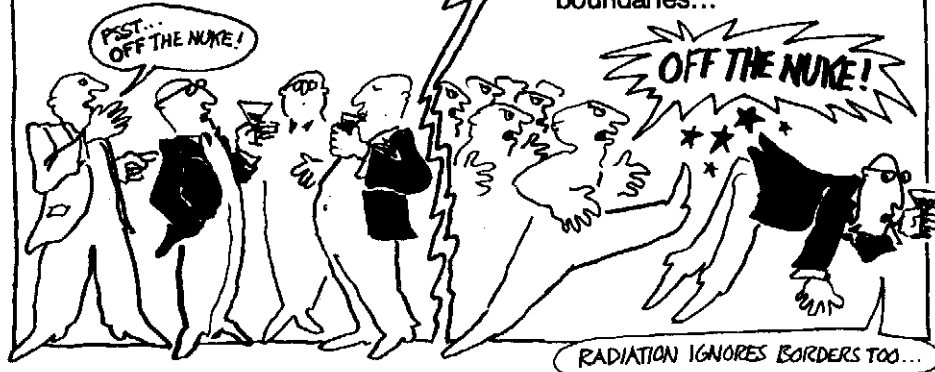
Opponents of nuclear power come in many shapes and sizes...

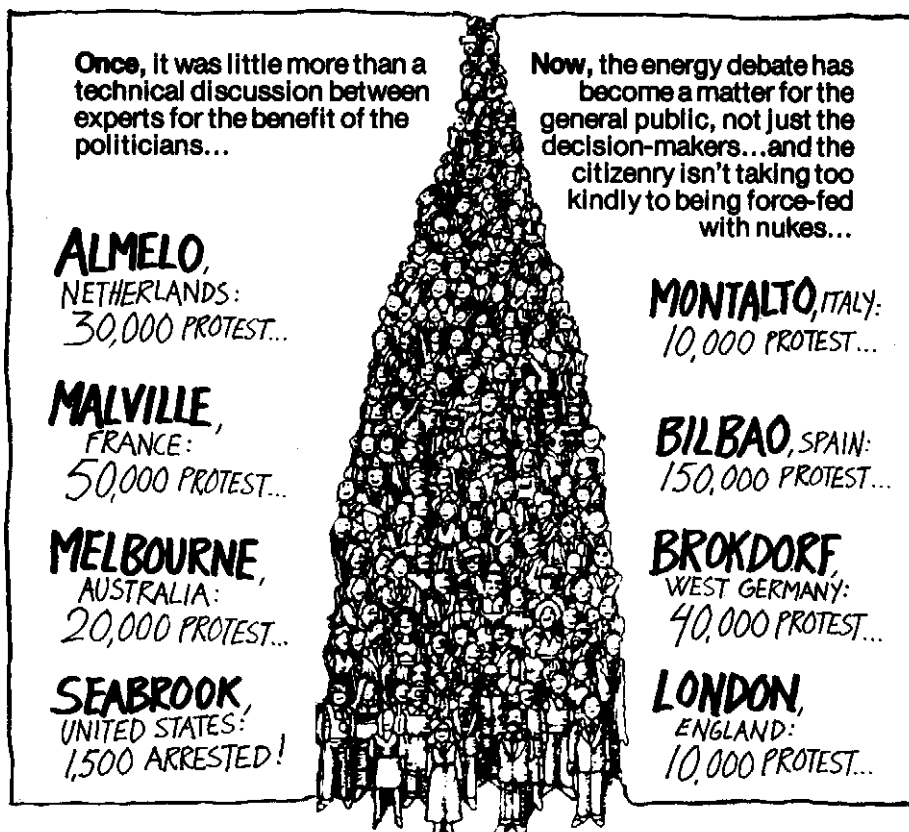
They're more or less agreed on the dangers of nuclear technology and on the advantages of the soft energy path...but they adopt widely differing approaches to the problem...with varying degrees of success...



In the beginning, resistance mainly took the form of lobbying government or challenging the nuclear builders at licence hearings, public inquiries and in court...

Today, the emphasis is shifting more and more to direct, non-parliamentary methods and to building a mass movement against nuclear power...sometimes linking up across national boundaries...





Not to mention Sam Lovejoy...

☛ On George Washington's Birthday, 1974 Samuel Holden Lovejoy toppled a 500-foot-tall weather tower in Montague, Massachusetts. The tower had been erected by the local utility company as part of their project to construct one of the largest nuclear power plants ever planned. Leaving 349 feet of twisted wreckage behind, Lovejoy hitched a ride to the police station, where he turned himself in and submitted a four-page written statement decrying the dangers of nuclear power. Six months later, Lovejoy defended his act of civil disobedience in court as «self-defence». He was ultimately acquitted. ☛

The anti-nuclear power movement is growing militant with the realisation that you can't de-rail the Nuclear Express by gentle persuasion...

THE ECOLOGISTS POINTED THE WAY...

Environment groups launched the anti-nuke movement and have long been its vanguard...they were the first to spell out the dangers of a hard energy future...to organise resistance...and to formulate alternatives...

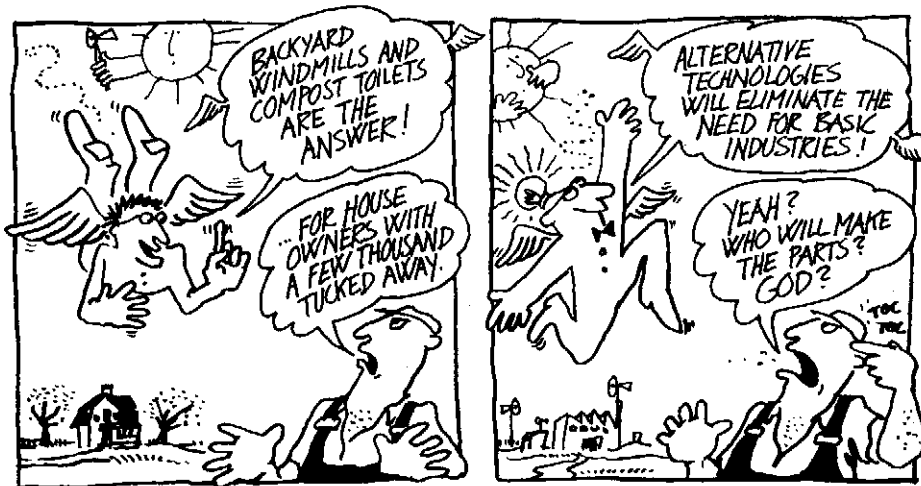
Adding an ecological dimension to the class struggle, radical environmentalists offered a fresh solution to the ravages of capitalism...but they also annoyed many dogged Marxists who kept insisting that technology was neutral...



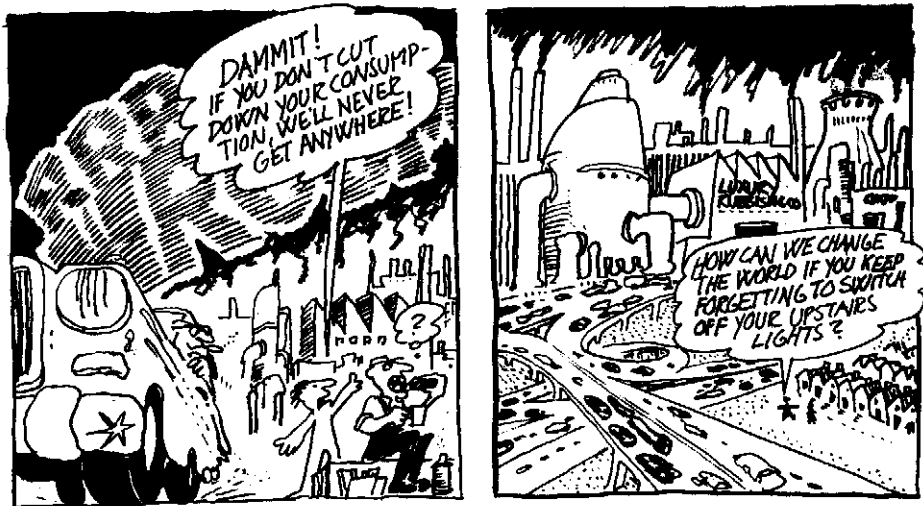
BUT SOME ECOLOGISTS LOST THEIR WAY...



OTHERS GOT CARRIED AWAY...



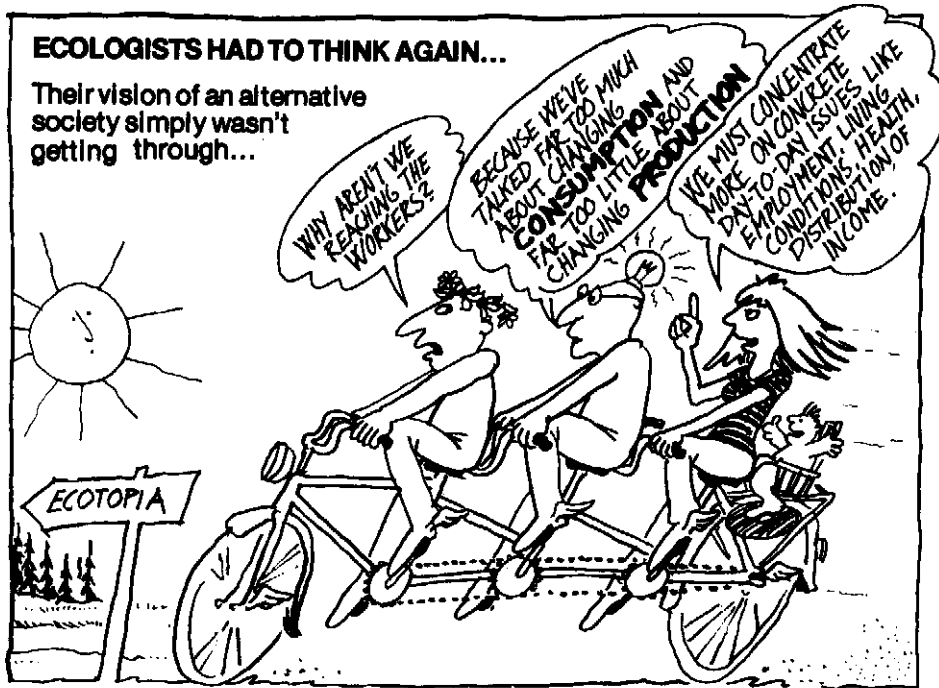
...AND MANY MISSED THE POINT...



SO IT WASN'T STRANGE THAT MUCH OF THE LABOUR MOVEMENT DISMISSED THE ENVIRONMENT MOVEMENT AS AN ASSEMBLY OF MIDDLE-CLASS CRAZIES OUT OF TOUCH WITH THE FACTS OF WORKING LIFE...

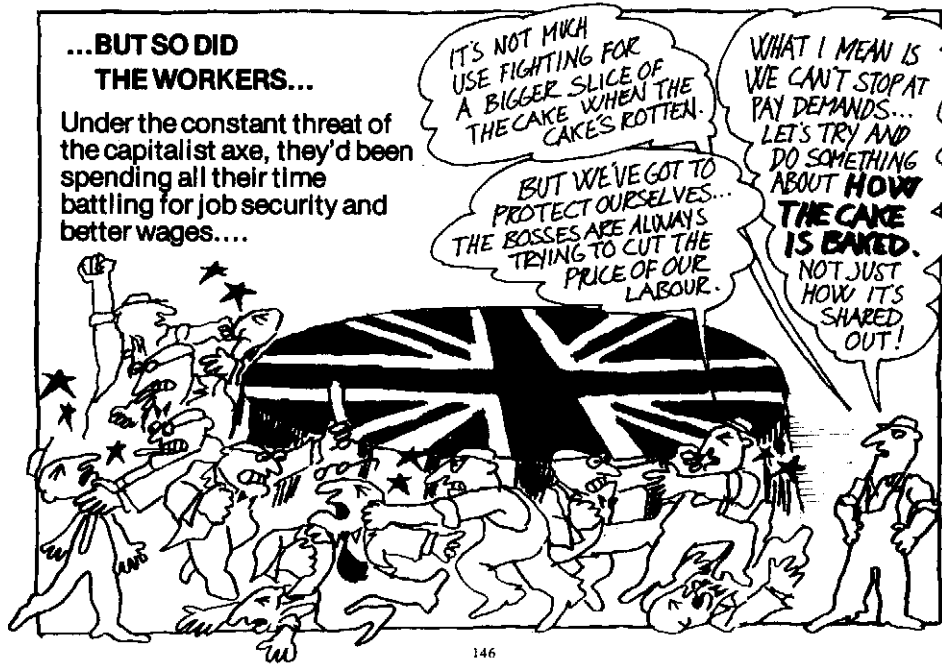
ECOLOGISTS HAD TO THINK AGAIN...

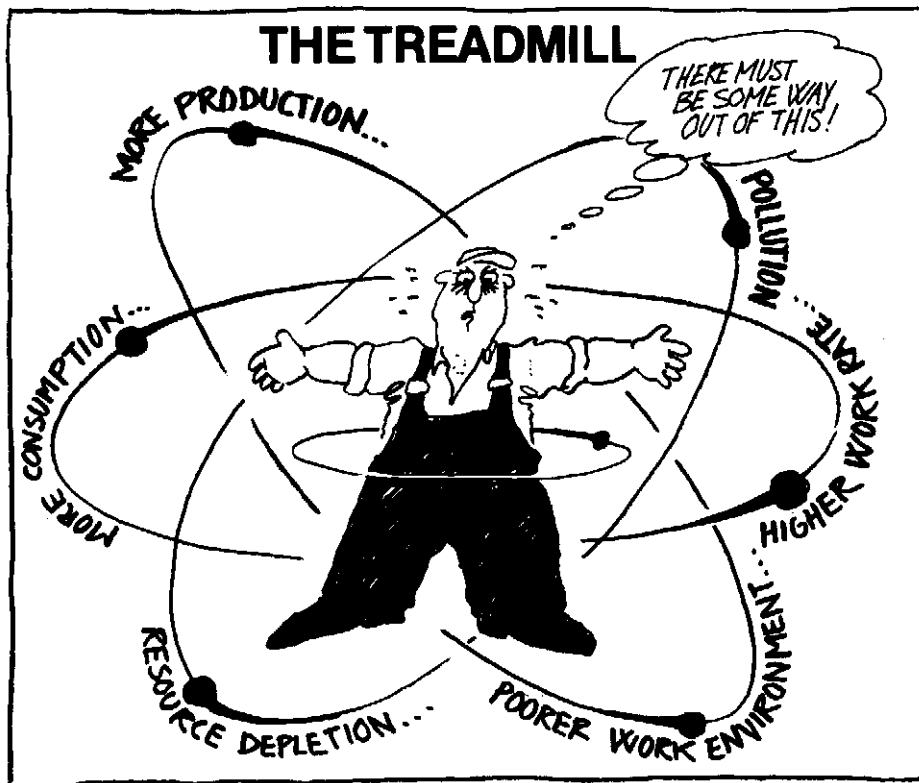
Their vision of an alternative society simply wasn't getting through...



...BUT SO DID THE WORKERS...

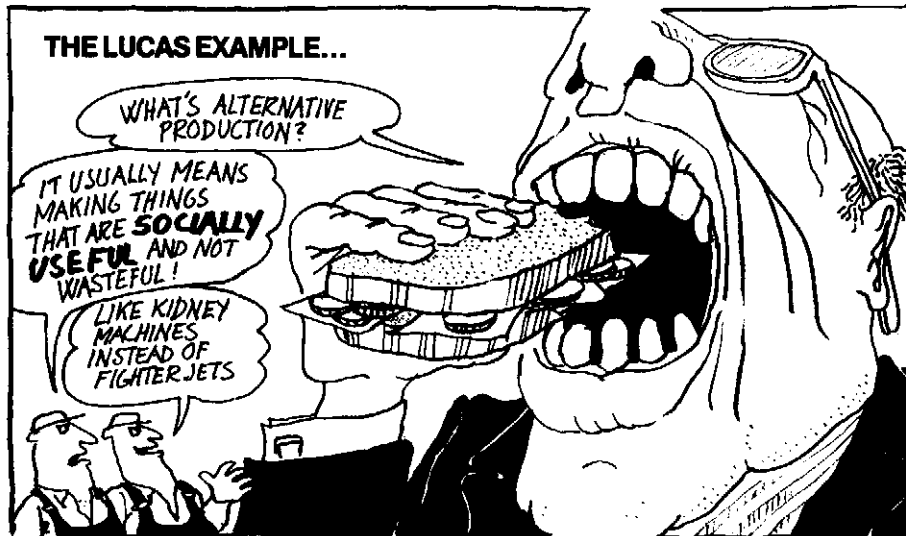
Under the constant threat of the capitalist axe, they'd been spending all their time battling for job security and better wages....





THE WORKERS STARTED LISTENING WHEN THE ENVIRONMENTALISTS STARTED TALKING THEIR LANGUAGE...





The workers and technicians at the British concern *Lucas Aerospace* campaigned for ALTERNATIVE PRODUCTION when threatened with closures and mass redundancies. The staff at the various Lucas plants formed a Combine Committee and drew up a full-scale Corporate Plan...proposing a move away from arms production to things like solar heating systems and wind generators, rubber-wheeled trains and insulation made from waste paper...



And the management's response?

The bosses refused to listen...which proved to everyone that reasoned argument makes no impression on vested interests... but news of Lucas workers' approach to the class struggle spread internationally...



ALTERNATIVE PRODUCTION

took root as an idea...it was:

- * discussed at workplaces from Lapland to Australia
- * proposed for other industries like steel, pulp, packaging, car-making and shipbuilding
- * raised in the British Parliament and the US Congress
- * closely examined by trade journals and some of the mass media

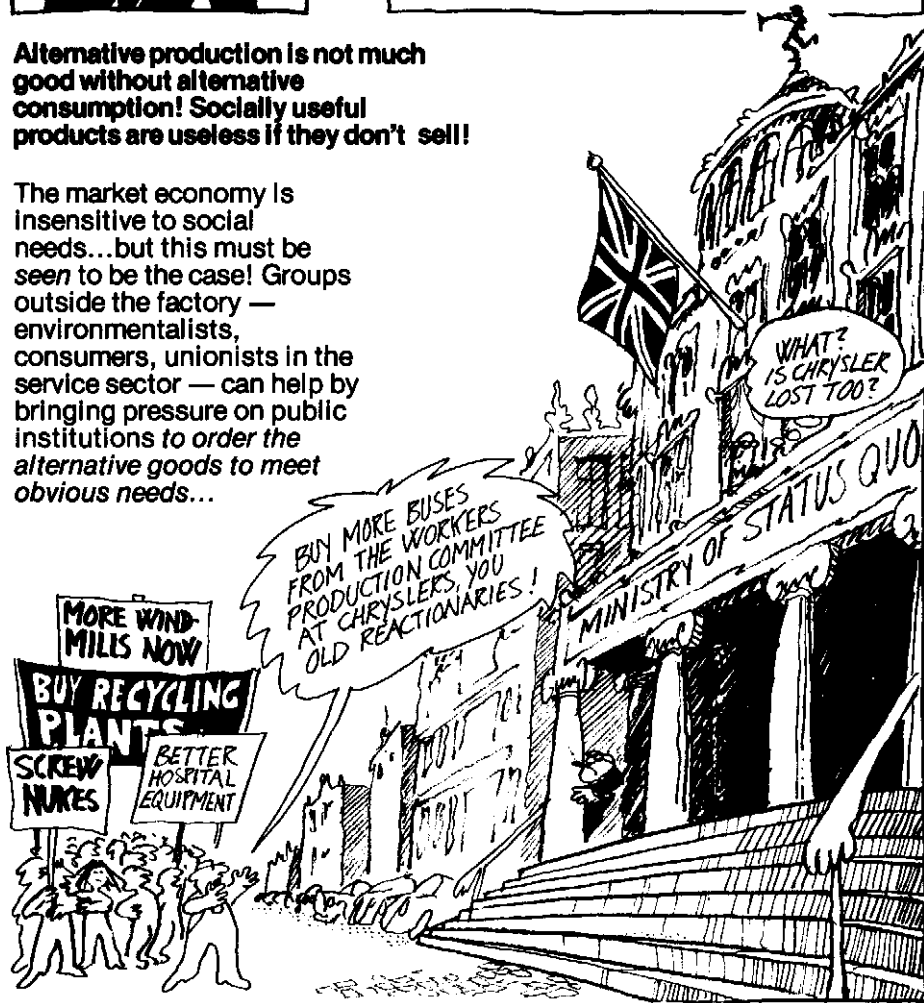
A centre for the development of socially useful products in industry was set up in London in 1978. And Lucas Combine Committee speakers travelled into Europe at the invitation of unions there...





Alternative production is not much good without alternative consumption! Socially useful products are useless if they don't sell!

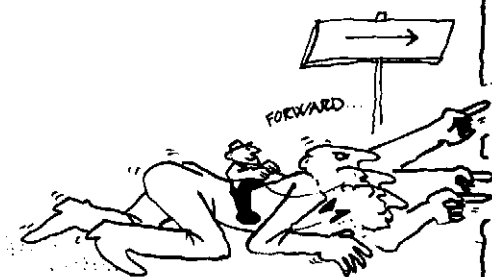
The market economy is insensitive to social needs...but this must be seen to be the case! Groups outside the factory — environmentalists, consumers, unionists in the service sector — can help by bringing pressure on public institutions to order the alternative goods to meet obvious needs...



The Lucas Alternative Plan provided more than a meeting ground for the labour and environment movements...It also united manual workers and white-collar professionals...



Changing and improving industrial production is only half the battle...concrete demands must be made in many other areas of daily life...all pointing in the direction of a better social structure...



TOWARDS A TOTAL PERSPECTIVE...

In the Public Services...



In housing areas...



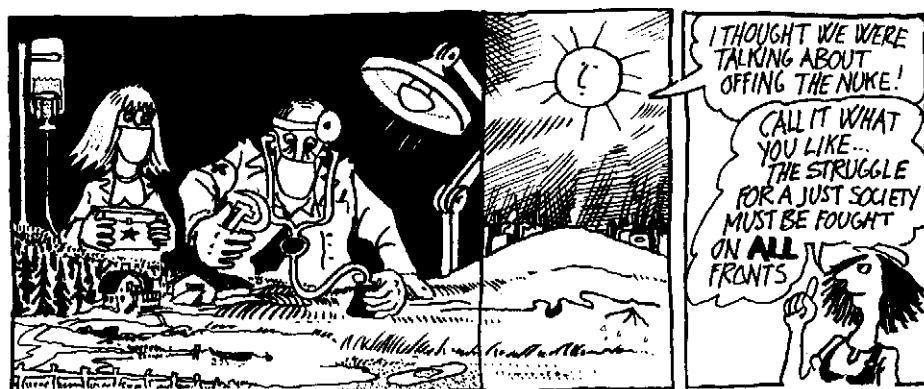
At the shops...



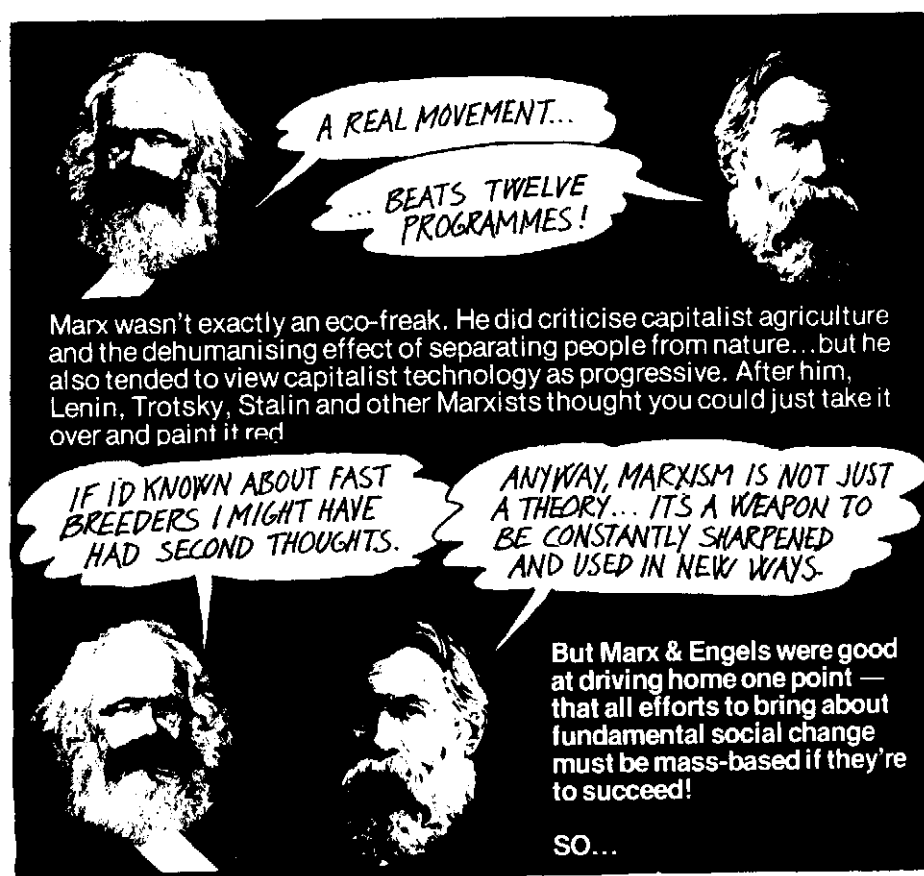
In public transport...



...AND A CO-ORDINATED DEMOCRATIC MOVEMENT!



To quote those wise old ideological fathers of socialism Marx & Engels...



TALK TO FRIENDS...NEIGHBOURS...RELATIVES...FELLOW-
WORKERS...TAKE PART IN ACTIONS...JOIN GROUPS...GO TO
MEETINGS...GET ACTIVE IN YOUR UNION...OR YOUR LOCAL
COMMUNITY...OR BOTH...KEEP INFORMED...USE YOUR
IMAGINATION...



**BETTER ACTIVE TODAY
THAN RADIOACTIVE TOMORROW**

**IN THE END
IT'S UP TO YOU**



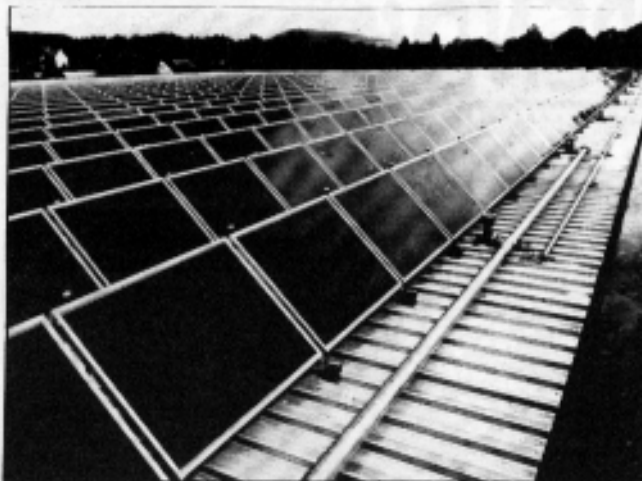
APPENDIX.



Alternative Energy Systems

The Sun...

Techniques harnessing the energy of the sun are being developed swiftly and widely. More than a century ago solar energy was used in Chile to desalinate water and in the US to power printing presses. Today it is in use in many fields and new applications are constantly being discovered.



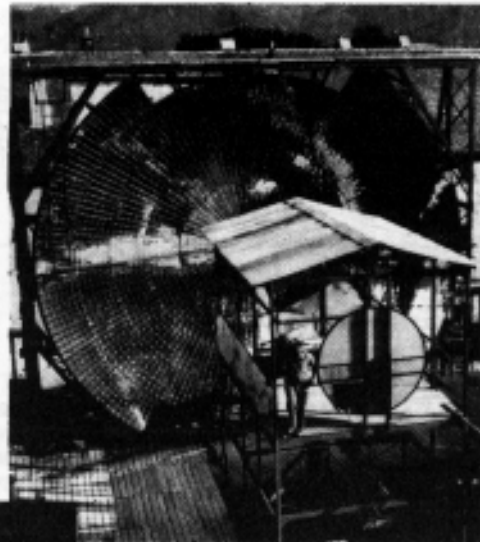
FLAT-PLATE SOLAR COLLECTORS for domestic heating are the commonest hardware. They have long been in use in hot countries like Israel, South Africa and Australia. Now they are in great demand in the US, where sales are trebling annually.

Heating water in a West German swimming pool...and a Welsh cottage

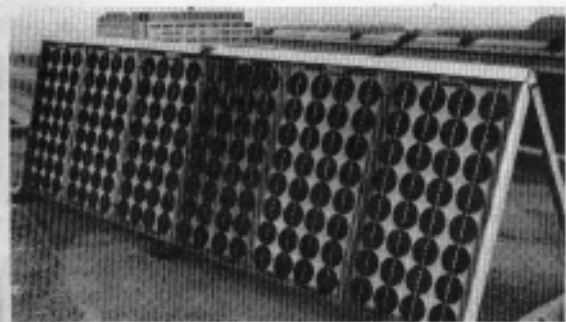


Collectors are also finding a market in cloudier regions like Scandinavia and Britain as a source of hot water in summer and low-temperature heating in winter. The heat is usually stored in water or rockbeds. Solar collectors can be applied to both large and small premises, 'back-fitted' to existing buildings or more simply, fitted into the structure from the start. They are most economically used by groups of households sharing storage.

SOLAR FOCUSING COLLECTORS reflect and concentrate the sun's rays on one spot. They range from gigantic high-temperature furnaces capable of melting metals to do-it-yourself cookers for boiling water and baking bread, etc.



French solar furnace...Third World grill made of bamboo, clay and foil...and a bank of solar [photo-voltaic] cells for the rich

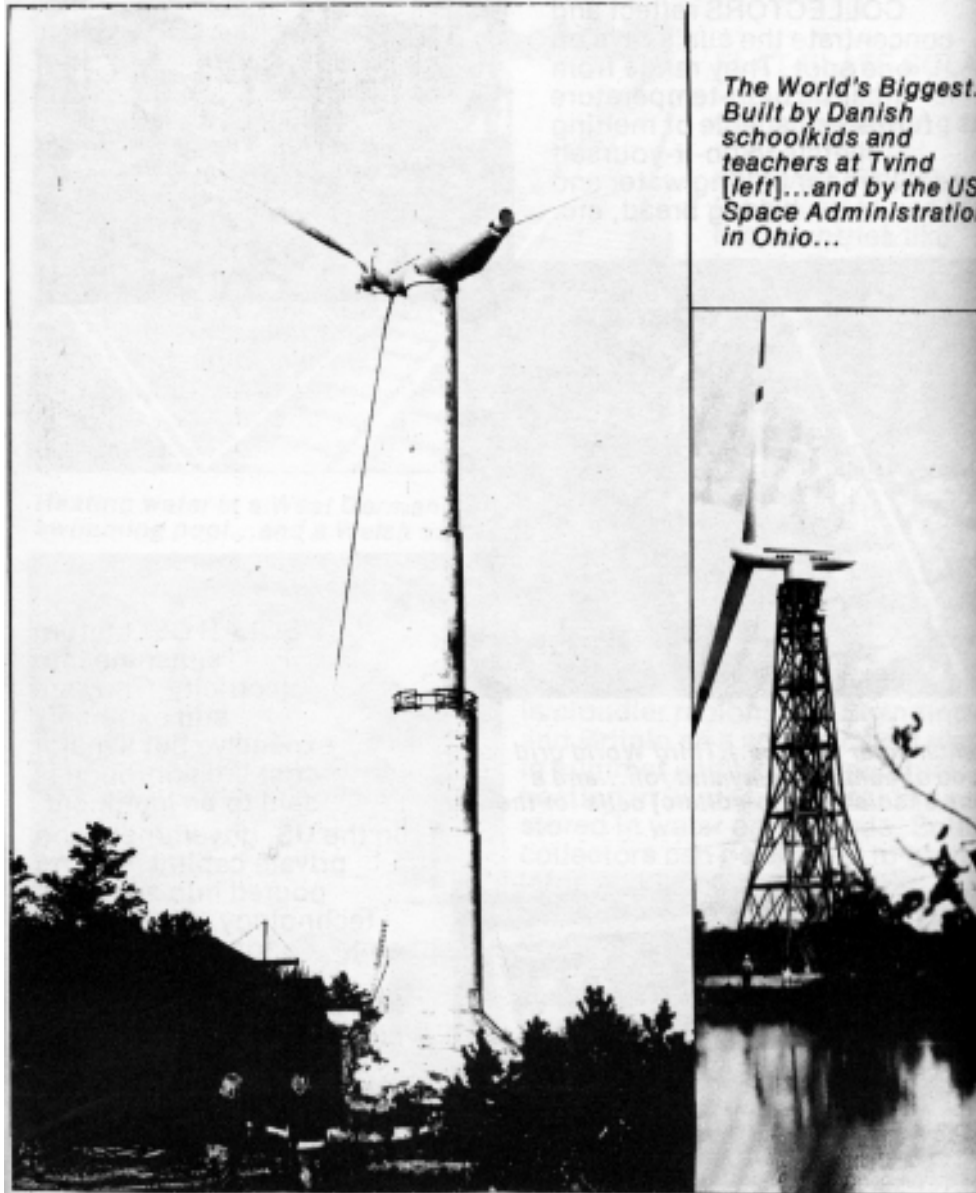


SOLAR CELLS turn sunshine into electricity. They are still extremely expensive but a major cost breakthrough is said to be imminent.

In the US, government and private capital is being poured into solar cell technology, which lends itself to monopoly. The same can be said of **SOLAR POWER TOWERS**, electric energy systems now being built in Sicily, France, Spain and the US. Ground mirrors provide the heat to turn a steam turbine in the tower.

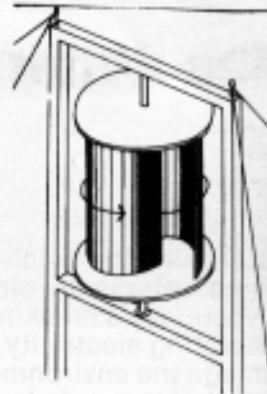
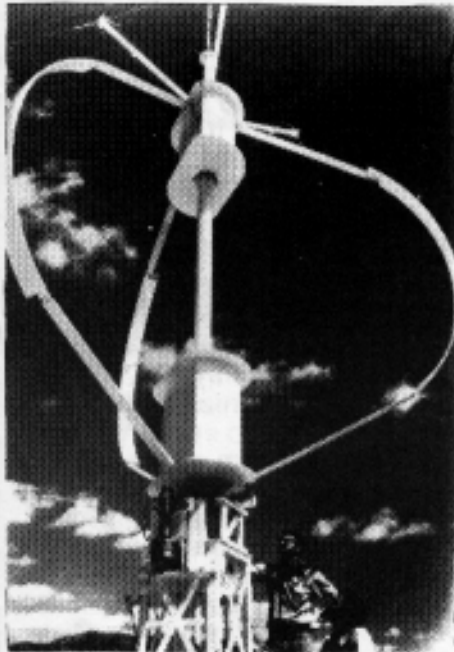
The Wind...

An endless source of energy with no pollutive side-effects, the wind has been put to good use since 2000 BC when the Chinese and Persians ground corn with it. Current **WIND POWER** systems can heat, pump, compress air and generate electricity. Designs range from massive turbines on 50-metre towers geared to electricity grid supply...



*The World's Biggest..
Built by Danish
schoolkids and
teachers at Tvind
[left]...and by the US
Space Administration
in Ohio...*

...down to the spinning oil drum variety for less ambitious ventures. The Greek island of Crete has over 100,000 small windmills pumping water for irrigation.



The Savonius Rotor...heavy but cheap and simple...and another vertical-axis wind generator, the high-speed Darrieus which the Danes and Canadians think may produce 1.5 MWe...

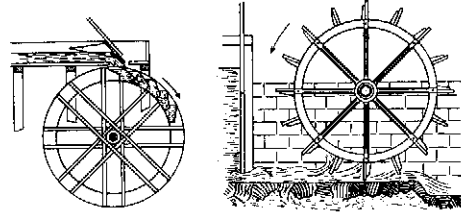
Wind energy is highly versatile and an aid to decentralisation. It can be used in many ways at the point of use, reducing the need for long, expensive and wasteful powerlines. Battery storage is most common but there's talk of an 'inverter' that switches over to the grid when there's no breeze around...and also works the other way, turning your electric meter backwards!



British studies suggest that unit-for-unit windpower's total cost is one-third that of nuclear power...and the World Meteorological Office says 20 million MWe is blowing about...

But the wind does not always blow and the sun does not always shine...so a mixture of the two (above) is useful. Good insulation lessens the need for both by reducing a building's heat requirements.

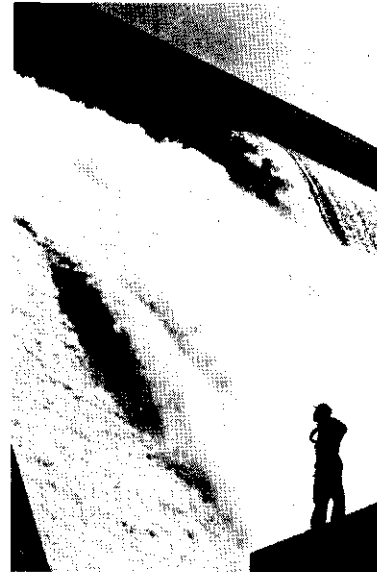
The Water...



Harnessing the mechanical energy in falling water is the oldest technique in the book. The modern successor to yesterday's creaking water wheels is the streamlined turbine generating electricity, often in huge dam projects. These frequently damage the environment and disrupt local cultures. But it is no longer accepted that only large volumes of water can be economical and there is growing interest in medium-sized

HYDRO-ELECTRIC POWER PLANTS,

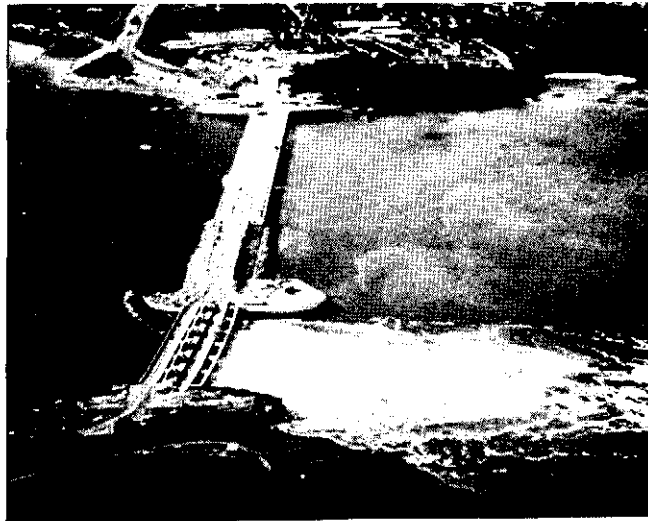
especially in Finland and the Soviet Union, while the plunging cost of small water turbines is making 'micro-stations' look attractive once more. Many countries have idle water wheels that can be revived to make electricity — there are 20,000 in England alone. China has built 60,000 in 15 years to supply 20% of her electricity needs. Most of the world's untapped water power is in the developing countries, especially in Africa, which has 20% of the global potential but generates a mere 2%.



Water power is the most reliable of the renewable energy sources. Except in extreme droughts it flows non-stop, strongest in winter when demand is greatest. However, most waterways these days are 'owned'...

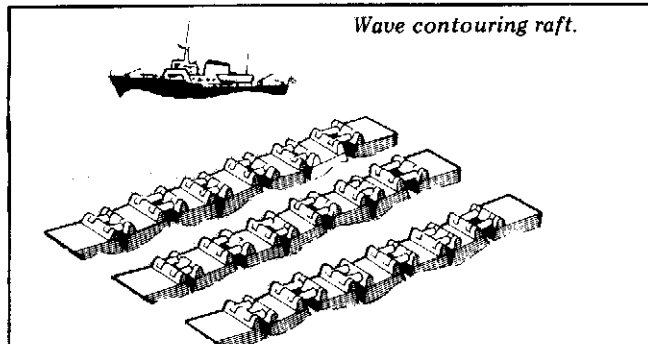


TIDAL POWER SYSTEMS exploit the ebb and flow of the tides so are not dependent on climate. A small scale station is operating in France, a larger one is being built in Canada's Bay of Fundy and a giant tidal power barrage across Britain's River Severn is under consideration.



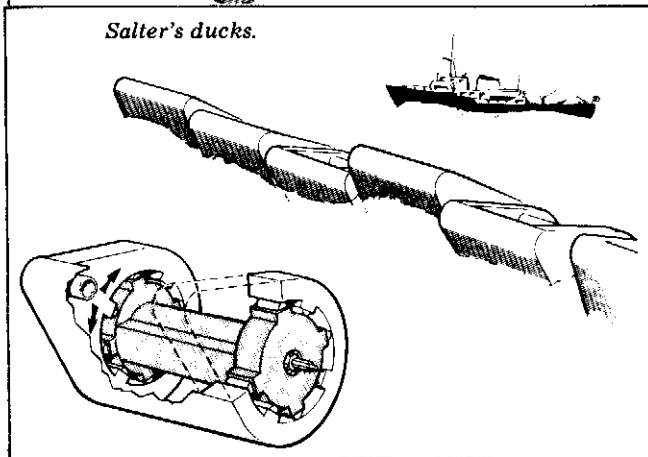
La Rance has been providing 240 MWe for 10 years...and two British wave-power designs with built-in turbines...

WAVE POWER techniques harnessing the energy of the ocean waves are mainly under development in Britain, Japan and Scandinavia. The Norwegians estimate that a 150-kilometre string of wave power units could supply 70,000 million kilowatt hours of electricity — the nation's current annual consumption.



Wave contouring raft.

OCEAN THERMAL POWER UNITS exploiting the difference in temperature between the sea depths and the surface are soaking up a lot of US government funds in anticipation of a mid-1980s market...



Salter's ducks.

The Earth...

Plants solved the energy crisis 3,000 years ago when they learned to create themselves out of earth, air and water. Now they're back in favour as 'biomass crops' or **BIO-FUELS**.



Apart from direct wood-burning, methods exist to tap the energy stored in plants, trees and organic waste by converting them into methane and other liquid and gaseous fuels for the transport sector. Special 'energy plantations' of fast-growing trees like alder and poplars (left) are being cultivated while ocean farming of giant seaweeds and other marine plants is also under way. Large-scale organic conversion presents some environmental problems like soil depletion and requires careful integration in forestry and agriculture.

Small-scale production of methane is a well-tested technology among Chinese and Indian farmers (right) whose air-tight digesters are mostly filled with cow-dung and human sewage. It is estimated that animal waste and crop residues on US farms could supply all the power needs of that country's enormous agricultural industry.



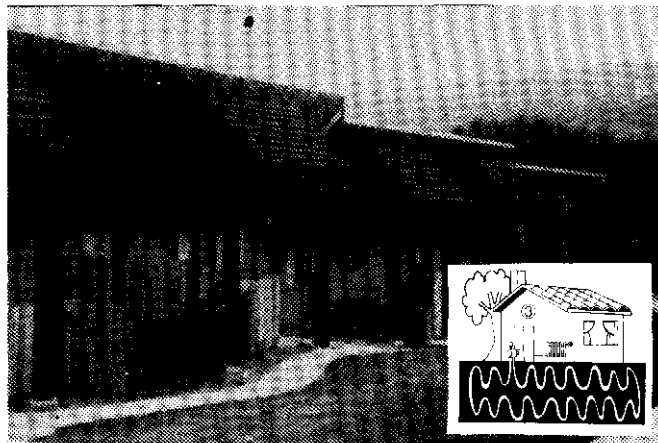
RECYCLING
metals, glass, wood,
paper, cloth, oil,
batteries and even
some plastics is
another energy-
saver... 'waste' is a
raw material in the
wrong place at the
wrong time!



GEO-THERMAL ENERGY,
drawing on the heat
deep in the Earth's crust,
is easiest to plumb in
volcanic regions but will
become available elsewhere
with better drilling
techniques. Another
centralised, high-technology
system for the energy
corporations and their state
backers.



HEAT PUMPS,
drawing on the
Earth's warmth or the
air, are already in
widespread use.
Many are powered
from the mains. New
designs link heat
pumps to wind and
solar energy
systems.



*Recycling scrap metal...geo-thermally heating a Paris block of
flats...and pump-heating a row of 12 Colorado apartments...*



URANIUM RESERVES

HIGH-YIELD up to \$80/kg cost-of-recovery

LOW-YIELD over \$80/kg

	(THOUSAND TONS)	
	HY	LY
Algeria	28	—
Argentina	17.8	24
Australia	289	7
Brazil	18.2	—
Canada	167	15
France	37	14.8
Gabon	20	—
India	29.8	—
Niger	160	—
South Africa/Namibia	306	42
Sweden	—	300
United States	523	120
Portugal	6.8	—
Spain	6.8	—
WORLD TOTAL* (32 countries)	1,510	590

*No data available for socialist states

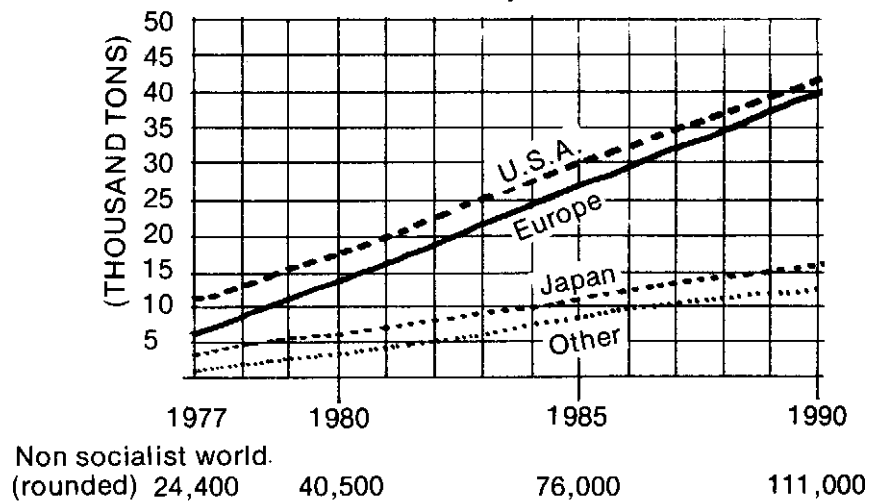
URANIUM PRODUCTION (1977) (TONS)

Argentina	130
Australia	400
Canada	6,100
France	2,200
Niger	1,609
Portugal	85
South Africa	6,700
Spain	191
US	11,200

Total (14 non-socialist countries)
28,617 tons

ACTUAL AND ESTIMATED URANIUM REQUIREMENTS

Source: Int. Symposium on Uranium Supply and Demand, London July 1978



ORGANISATIONS AGAINST NUCLEAR POWER



Australia

Movement Against Uranium Mining (MAUM), 277 Brunswick St, Fitzroy, Victoria 3065.

Community Research Action Centre, Monash University Union, Clayton, Victoria 3168.

Friends of the Earth, 232 Castlereagh St, Sydney, New South Wales 2001.

Austria

Initiative Österreichischer Atomkraftwerksgegner (IOAG), Postfach 138, 1071 Vienna.

Belgium

Amis de la Terre, Rue E. Walschaert 19, 1060 Bruxelles.

Verenigde Aktiegroepen voor Kernstop (VAKS), Consciencestraat 46, 2000 Antwerpen.

Britain

Socialist Environment & Resources Association (SERA), 9 Poland St, London W1V 3DG.

Scottish Campaign to Resist the Atomic Menace (SCRAM), 2a Ainslyplace, Edinburgh 3.

Friends of the Earth, 9 Poland St, London W1V 3DG.

Nuclear Information Network (NIN), 29 Great James St, London WC1.

London Greenpeace, 6 Endsleigh St, London WC1.

Colonialism & Indigenous Minorities Research Action (CIMRA), 70 Durham Rd, London N7.

Canada

Canadian Coalition for Nuclear Responsibility (CCNR), 2010 Mackay St, Montreal, Quebec H3G 2J1.

Saskatoon Environmental Society, PO Box 1372, Saskatoon, Saskatchewan S7K 3N9.

Denmark

Organisationen til Oplysning om Atomkraft (OOA), Skindergade 26, DK-1159 Copenhagen K.

Finland

Alternative till Kärnkraft, PB 143, 00201 Helsinki 20.

France

Coordination Antinucléaire Région Parisienne, C/o Yves Behar, 3 rue Félix Ziem, 75018 Paris.

Comité contre la pollution dans la Hague, BP 156, 50104 Cherbourg Cédex.

Comité contre le Super-Phénix
(Malville), C/o Marie Dubost, Iselet,
Morestel.

Amis de la Terre, 117 Av. de Choisy,
75013 Paris.

Comité de Sauvegarde de Fessenheim
et de la plaine du Rhin (CSFR), C/o J.J.
Rettig, Ecole de Champenay, 67420
Saales.

West Germany

Bunderversband Bürgerinitiative
Umweltschutz (BBU), Schiffkopfweg
31a, 75 Karlsruhe 21.

Bürgerinitiative Umweltschutz
Untereibe (BUU), Schlüterstr. 4, 2000
Hamburg 13.

Anti-AKW-Laden, Lutterothstr. 33, 2000
Hamburg 19.

Bürgeraktion Küste (BAK),
Bückerburgerstr. 50, Bremen 2800.

Gruppe Internationalismus in der
Bremer Bürgerinitiative gegen
Atomanlagen, Fedelhöfen 14, 28
Bremen 1.

Ireland

C/o John Carroll, Irish TGWU, Liberty
Hall, Dublin 1.

Japan

Jishu Koza, Masafumi Takubo, B.
Kaikan, Nishi Okubo 2-350,
Shinjukuku, Tokyo.

Luxemburg

Bürgerinitiative Museldal, C/o Jemp
Weydert, 51 rue demy Schlechter,
Luxemburg.

Netherlands

Landelijk Energie Komitee (LEK), 2e
Weteringplantsoen 9, Amsterdam.

New Zealand

Friends of the Earth, Box 39-065,
Auckland West.

Norway

Aksjon mot Atomkraft, PB 8395,
Hammersborg, N. Oslo 1.

Spain

Comision de Defensa de una Costa
Vasca no Nuclear, Avenida Basagoiti
28, Algorta.

Comité Antinuclear de Catalunya
(CANC), Bruc 26 Zon., Barcelona 10.

Sweden

Folkkampanjen mot Atomkraft,
Tjärhovsgatan 44, 11629 Stockholm.

Milljöförbundet, Box 2129, 750 02
Uppsala.

Switzerland

National Koordination der Schweizer
Anti-AKW-Organisationen, C/o André
Froidevaux, Burgunderstr. 4, 4051
Basel.

Schweizerische Energiestiftung (SES),
Auf der Mauer 6, 8001 Zurich.

United States

Abalone Alliance, 452 Higuera St, San
Louis Obispo, California 93401.

Cactus Alliance, 106 Girard SE, Rm
121 C, Albuquerque, New Mexico 87106.

Clamshell Alliance, PO Box 30,
Montague Center, Massachusetts
01351, and 22 Congress St,
Portsmouth, New Hampshire 03801.

Community Energy Action Network, PO
Box 33686, San Diego, California
92103.

Mobilization for Survival, 1213 Race St,
Philadelphia 19107.

Natural Resources Defence Council,
917 15th Street, Washington, D.C.
20005.

Friends of the Earth, 124 Spear Street,
San Francisco, California 94105.

General

World Information Service on Energy
(WISE), 2e Weteringplantsoen 9,
Amsterdam, Netherlands.

International Mobilisation for Survival,
C/o ICDP, 6 Endsleigh St, London
WC1, Britain.

TIPS FOR FURTHER READING

Books

The Politics of Nuclear Power. Ed D. Elliot. Pluto Press 1978.
The Hazards of Nuclear Power. Roberts & Medvedev. Spokesman 1978.
The Risks of Nuclear Power Reactors. UCS, Boston, Mass, USA, 1977.
Nuclear Power. J. Berger. Ramparts 1976.
Nuclear Power. W. Patterson. Penguin 1976.
The Fissile Society. W. Patterson. Earth Resources 1977.
Nuclear Prospects. Flood & Grove-White. FOE/CPRE/NCCL 1977.
The Big Red Nuclear Diary. Pluto Press 1978. Ed D. Smith.
The Flowers Report (on nuclear power). Cmnd.6618 HMSO London 1976.
Soft Energy Paths. A. Lovins. Penguin 1977.
Tools for Conviviality. I. Illich. Calder & Boyars, London 1973; Harper & Row, New York, 1974.
Energy and Equity. I. Illich. Marion Boyars 1974.
Radical Technology. Eds Harper & Boyle. Wildwood House 1976.
Post-Scarcity Anarchism. M. Bookchin. Ramparts 1971, Wildwood House 1973.

Papers, articles, comix...

'Nuclear Power — Who Needs It?' Science for the People Vol. 8 No. 3 May 1976.
The Leveller Energy Issue. No. 12. Feb 1978. 155a Drummond St, London NW1.
'Nuclear Power — No Thanks!' FOE 1977. 9 Poland St, London W1.
Nuclear Times. FOE 1978.
An Alternative Energy Strategy for the UK. NCAT, Machynlleth, Powys, Wales.
All Atomic Comics. Last Gasp Educomics 1976. From 112 Fellows Rd, London NW3.

Periodicals

Undercurrents, 27 Clerkenwell Clo, London EC1R 0AT, Britain.
New Scientist, 128 Long Acre, London WC2E 9OH.
Science for People, 9 Poland St, London W1.
Science for the People, 9 Walden St, Jamaica Plain, MA 02130, USA.
Bulletin of the Atomic Scientists, 1020-24 East 58th St, Chicago, Ill 60637.
Environment, 438 N. Skinker Boulevard, St Louis, Mo. 63130.
Spark, CSRE, 475 Riverside Drive, New York, NY 10027.
Radical Ecologist, PO Box 87, Carlton South, Victoria 3053, Australia.
Chain Reaction, from FOE, 232 Castlereagh St, Sydney, NSW 2001, Australia.
Agenor, 13 Rue Hobbema, 1040 Brussels, Belgium.
La Gueule Ouverte, BP 26, 71800 La Clayette, France.
Survivre et Vivre, 6 Rue Chappe, 75018, Paris, France.

NUCLEAR POWER FOR BEGINNERS

By Stephen Croall and Kaianders Sempler

Sorry, this book doesn't show you how to build your own household reactor...nor how to make a backyard A-bomb from nuclear fuel (that information is freely available elsewhere!)

But you'll discover what could happen when the Human Factor meets the Breeder Reactor. And what the China Syndrome is all about. And how today's technology shapes tomorrow's lifestyles. And who *really* needs nukes...

Apart from showing good reason why the Nuclear Express should be halted, the book explores alternatives and suggests how to get on the right path...



Writers and Readers



Beginners Books

£1.80

ISBN 0 906386 00 4

Including the
ALTERNATIVES!

